ASTEROIDEA

BY

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WITH TWO TEXT-FIGURES AND TWELVE PLATES.

INTRODUCTION.

Many of the specimens were secured on reefs of dead and living coral which encircle Low Isles, and, as was to be expected, *Linckia laevigata* was by far the most abundant species during the period of my visit. The discovery of *Nardoa pauciforis* living in association with *Nardoa novaecaledoniae* was fortunate, as it confirms past records of their occurrence together and the fact that their coloration in life is practically identical.

The finding of *Culcita novaeguineae* considerably extends the known range of the genus.

By far the most interesting material was that obtained by dredging. These specimens add much to our knowledge of the Australian asteroid fauna.

A representative set of specimens will be deposited in the British Museum (Nat. Hist.); the remainder, including types, will be placed in the collection of the Australian Museum, Sydney.

I wish to thank Dr. C. M. Yonge, Leader of the Expedition, for the opportunity of studying this collection, and Mr. G. C. Clutton, of the Australian Museum, for the care and skill he has exercised in the preparation of most of the photographs here reproduced.

Through the kindness of Mr. C. C. A. Monro, of the British Museum, I have been able to examine and incorporate in this work photographs of type and other material in the British Museum. I wish to record my gratitude for his kind assistance.

Although this is essentially a report upon the Asteroidea collected by the expedition, it has been found necessary in some cases to refer to specimens in other collections, so as to understand fully the material before me.

The species referred to in the report are as follows. Those marked with an asterisk were not collected by the expedition :

Astropecten polyacanthus, M. and Tr.
Astropecten granulatus, M. and Tr.
Astropecten zebra, Sladen.
Luidia forficifera, Sladen.
Archaster typicus, M. and Tr.
Tosia queenslandensis, sp. nov.
Stellaster incei, Gray.
**Stellaster equestris*, Retzius.
**Stellaster princeps*, Sladen.
Anthenea tuberculosa, Gray.
Oreaster australis, Lütken.
Oreaster nodosus (Linnaeus).
**Oreaster alvcolatus*, Perrier.
Culcita novaeguineae, M. and Tr.
Asterope carinifera (Lamarck).
Fromia milleporella (Lamarck).
Nardoa pauciforis (v. Martens).
Nardoa novaecaledoniae (Perrier).
Nardoa rosea, H. L. Clark.
Linckia guildingii, Gray.
Linckia laevigata (Linnaeus).
Ophidiaster propinquus, sp. nov.
Tamaria fusca, Gray.
Tamaria mcgaloplax (Bell).
**Tamaria hirsuta* (Koehler).
**Tamaria ornata* (Koehler).
**Tamaria* sp.
Nepanthia (? *brevis*) (Perrier).
Patiriella exigua (Lamarck).
Echinaster luzonicus (Gray).
Metrodira subulata, Gray.
Acanthaster planci (Linnaeus).
Retaster insignis, Sladen.

SYSTEMATIC ACCOUNT.

Astropecten polyacanthus, Müller and Troschel.

Astropecten polyacanthus, Müller and Troschel, Syst. der Asteriden, 1842, p. 69, pl. v, fig. 3; Fisher, Bull. U.S. Nat. Mus. 100, III, 1919, p. 63; H. L. Clark, Rec. Aust. Mus. XV, 1926, p. 184.

Localities.—Dredged N.E. Low Isles, 8 fathoms, mud and stones, September, 1928 (1). Station XXIV. 13.iii.1929. Three-quarters of a mile N.E. Pasco Reef, 16½ fathoms, hard shell bottom (1).

Distribution.—Red Sea to Zanzibar and Mozambique; Seychelles; Ceylon; Mergui; Andaman Islands; China; Japan; Philippines; Port Jackson, N.S.W.; Queensland; Admiralty Islands; Aru Islands; Fiji Islands; Hawaiian Islands.

Two specimens: R. = 72 mm., and 55 mm. The smaller specimen is badly distorted, and its R. measurement is only approximate.

Astropecten granulatus, Müller and Troschel.

(Plate VIII, figs. 2 and 3.)

Astropecten granulatus, Müller and Troschel, Syst. der Asteriden, 1842, p. 75; Döderlein, Denkschr. med.-naturw. Ges. Jena, VIII, 1896, p. 305, pl. xviii, figs. 30–30*a*; H. L. Clark, "The Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 26.

Locality.—Low Isles, off N. Anchorage, 9 fathoms, low tide, 17.x.1928 (Agassiz trawl) (1).

Distribution.—Arafura Sea; Torres Strait; Queensland; Aru Islands; Philippines; Natal.

The single specimen has R. = 38 mm.

Astropecten zebra, Sladen.

Astropecten zebra, Sladen, J. Linn. Soc. Zool. XVII, 1883, p. 261; Sladen, "Challenger" Zool. XXX, 1889, p. 212, pl. xxxvi, figs. 3, 4; pl. xxxix, figs. 7–9; H. L. Clark, "The Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 27 (and synonymy).

Locality.—Dredged quarter-mile S. of Cape Kimberley, 2.xii.1928, 4 fathoms, shell and gravel (2).

Distribution.—" The range of *zebra* appears to be from the Murray Islands westward through Torres Strait and northward to the Mergui Archipelago and the coast of Madras," H. L. Clark (*loc. cit.*). Queensland.

Two specimens : R. = 32 mm., 29 mm.

Luidia forficifera, Sladen.

Luidia forficifer, Sladen, " Challenger " Zool. XXX, 1889, p. 258, pl. xliv, figs. 5, 6 ; pl. xlv, figs. 5, 6 ; Döderlein, " Siboga " Exped., Mon. XLVI*b*, 1920, pp. 243, 278, figs. 28, 29 and fig. 3 in text (and synonymy) ; H. L. Clark, " The Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 28.

Locality.—Station 12. 24.ii.1929. Penguin Channel, 10–15½ fathoms, rock and shell gravel, mud on edges of pit (2).

Distribution.—See Döderlein (*loc. cit.*, p. 243).

Two representatives of the genus *Luidia* (R. = 26 mm. and 21·5 mm.—both measurements from specimens in a slightly curled condition) are before me. After careful comparison with Sladen's description and figures they are considered referable to the above species.

Archaster typicus, Müller and Troschel.

Archaster typicus, Müller and Troschel, Mber. k. preuss. Akad. Wiss. 1840 p. 104 ; Müller and Troschel, Syst. der Asteriden, 1842, p. 65, pl. v, fig. 2, *a* and *b* ; Sladen, " Challenger " Zool. XXX, 1889, p. 123 ; Fisher, Bull. U.S, Nat. Mus. 100, III, 1919, p. 180.

Localities.—Gen. Survey. The Sand Flat ; between Anchorage Reefs and Mangrove Park (4).

Distribution.—Widely distributed over Pacific and Indian regions.

Specimens of this species were commonly discovered on the sand flats at low tide, where they were partially buried.

Tosia queenslandensis, sp. nov.

(Plate V, figs. 1, 2, 7.)

Locality.—Pixie Reef, 6.vi.1929 (2). Paratype in the British Museum.

Distribution.—Great Barrier Reef, Queensland (Pixie Reef and Masthead Island, Capricorn Group).

Description.—Rays five. Two specimens examined : R. = 17 mm. ; r. = 10 mm. R. = 1·7 r. in larger specimen. Smaller specimen : R. = 13 mm. ; r. = 7 mm. ; R. = 1·8 r.

Rays well produced for a *Tosia*, tapering rapidly towards their extremities. Interbrachial arc comparatively deep and well rounded. Abactinal surface paved by a number of polygonal plates which are, for the most part, arranged in regular radiating series. Each plate is separated from its neighbour by a double row of large well-developed squarish

granules, which are plainly larger than those occurring on specimens of *Tosia australis* of the same size.

The abactinal plates are largest centrally, though plates in the distal portion of the median radial series may be larger than their immediate neighbours. This is particularly noticeable in the smaller specimen (R. = 13 mm.). The plates of the abactinal surface are mostly flat or very slightly depressed centrally, or ovate. The exceptions are the last three or four plates in the median radial series, which are conspicuously raised and dome-like—a condition particularly noticeable in the last plate of the series.

All plates of the abactinal surface, including the superomarginals, appear smooth at a casual glance, but minute inspection reveals them to be granular. The granules are not such as will rub off, but are scupltured on the plate, forming a definite and inseparable part of it. In other words the plates may be described as being pitted.

The superomarginal plates vary in number—either eight or nine being present. The inferomarginals number twelve. The superomarginals are not usually large, and are, with the exception of abnormal ones, of approximately uniform size. The inferomarginals are smaller than the superomarginals, particularly near the tips of the rays. Plates near the tips of the rays in both series of marginals are noticeably raised and swollen. A large terminal plate occurs, which is larger than any marginal, and possesses a small, though deep, pit on its tip.

The madreporite is larger than most plates of the abactinal surface. It is triangular with outwardly rounded or bulging sides, and separated from the abactinal plates bounding it by a single row of granules.

Inferomarginal and actinal plates much smoother than abactinals, yet showing faint traces of the type of granulation described above. The actinal plates are, on the whole, smaller than the abactinals. They are flat or slightly convex, and separated from one another by a double row of granules. The marginals are also separated by a double row of granules.

The adambulacral armature consists of a furrow series of two to three short, stout spines of equal length and size. At the back of each comb there are two or three granule-like spinelets. These latter merge into the general granulation.

Colour.—According to the label the colour in life is crimson.

Remarks.—This species is a member of the genus *Tosia*, as understood and restricted by Fisher (1919). Its nearest relative appears to be *Tosia australis*, Gray, but even to this species it is not nearly related. In the first place, *T. queenslandensis* is identifiable by the large and conspicuous terminal tubercle and the resulting marked derangement of the inferomarginal plates ; by the deeply sinuated interbrachial arcs and the unusually heavy granulation separating the plates of both surfaces. In addition, the animal is much thicker and more stoutly constructed than any specimens of *T. australis* of the same size seen by me.

Besides the two specimens secured by the British Expedition, there is another in the Australian Museum from Masthead Island, Capricorn Group, Queensland, collected by W. Boardman and M. Ward in 1929. This specimen agrees in detail with the examples from the Barrier Reef.

T. queenslandensis seems to be a rare species, there being only three specimens known. Of the numerous collecting parties to the Great Barrier Reef none but the present expedition has met with it.

Stellaster incei. Gray.

(Plate I, figs. 3—6; Plate II, figs. 2—5.)

Stellaster incei, Gray, Proc. Zool. Soc. Lond. 1847, p. 76; Fisher, Bull U.S. Nat. Mus. 100, III, 1919, p. 326, pl. lxxix, figs. 1–3; pl. lxxx, fig. 1 (and synonymy); H. L. Clark, "The Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 29.

Locality.—Low Isles, about one mile north from the Northern Moat, 12 fathoms (1).

Distribution.—"East to the Mozambique coast (Simpson and Brown), India and Ceylon, Mergui Archipelago, Sumatra and Singapore, Philippines to Korea (? Sladen), south to New Guinea, Arafura Sea, Torres Strait, North, North-east and South Australia" (Fisher, 1919); Queensland.

A specimen dredged in 12 fathoms off Low Isles is undoubtedly referable to this very variable species. It has been compared with material in the Australian Museum Collection identified by H. L. Clark, and found to agree in all the specific characters. R. = 82 mm. on the specimen before me, and on the abactinal surface 49 tubercles, and 11 scars of missing tubercles, are to be seen. Each furrow comb is made up of from six to seven (usually seven) very slender spines, which are webbed for a full three-quarters of their length. The webbed section is conspicuously corrugated owing to the presence of the spines. The subambulacral spines are flat and rounded at their free extremity. They occur usually in pairs, one spine being a little longer than its fellow. Rarely three spines are found together, and then the median spine is slightly larger than its fellows, which are more or less equal in size. Usually a small tubercle occurs on the outside of each spine, near the base, and just above the place of articulation. The large pincer-shaped pedicellariae, referred to by Fisher, agree with his account.

In a specimen from 25 miles S.E. of Double Island Point, Queensland, 35 fathoms, identified by H. L. Clark as *Stellaster incei*, the subambulacral spines are equal in number to those of the specimen before me, but very unequal in size. The spines of the furrow comb are webbed for less than half their length, and the abactinal tubercles are very few. Pedicellariae occur as described by Fisher.

In a specimen of *Stellaster incei* from Western Australia, which is in the Australian Museum collection, the characters are similar in most respects to those of the present examples, but there is a difference in the relative lengths of the spines of the furrow comb. The central pair are long and equal in length. The next adjoining pair are closely adpressed to the central pair, and are substantially shorter. The next two, which are on the outside, are only half as long as the central pair. A seventh spine sometimes occurs in the comb, and is usually stumpy and barely discernible. The spines of the comb are inconspicuously webbed for only a short distance.

Fisher's remark (*loc. cit.*, p. 328) that the "relationship between *incei* and *equestris* is by no means clear," has led me to examine a specimen of *equestris* in the Australian Museum from Nagasaki, Japan, 57 fathoms, collected by the "Vega" expedition in 1879, and identified presumably by Prof. T. Odhner, of Stockholm, from whom the specimen was received. In this specimen R. = 58 mm., and, after comparing it with a specimen of *S. incei* (R. = 59 mm.) from Albany Passage, North Queensland, 9–12 fathoms, collected by M. Ward, I prepared the following table with a view to providing a satisfactory means of discriminating the two species.

Stellaster incei. (Specimen from Albany Passage, North Queensland, 9–12 fathoms. R. = 59 mm.	*Stellaster equestris.* (Specimen from Nagasaki, Japan, 57 fathoms. R. = 58 mm.).
(1) Abactinal surface fairly rugged, uneven when dry, and studded with tubercles.	(1) Abactinal surface comparatively smooth, when dry, and devoid of tubercles.
(2) Superomarginal plates conspicuously tumid and well defined.	(2) Superomarginal plates only very slightly tumid and not well defined.
(3) Superomarginal plates in interbrachial arc comparatively narrow—2·75 mm. wide across middle.	(3) Superomarginal plates in interbrachial arc comparatively wide—3·75 mm. across middle.
(4) Inferomarginal plates narrow in interbrachial arc—3 mm. wide across middle.	(4) Inferomarginal plates in interbrachial arc comparatively wide—4 mm. wide across middle.
(5) Superomarginal and inferomarginal plates low. Measurement from top of superomarginal plate to bottom of inferomarginal plate in middle of interbrachial arc, 5 mm.	(5) Superomarginal and inferomarginal plates high. Measurement from top of superomarginal plate to bottom of inferomarginal plate in middle of interbrachial arc, 8 mm.
(6) General granulation comparatively coarse.	(6) General granulation fine.
(7) Rays noticeably narrow at base.	(7) Rays wide at base.
(8) Only adambulacral pedicellariae occur (at this age).	(8) Ventrolateral as well as adambulacral pedicellariae present.
(9) Subambulacral spines 2–4 (usually 3) in number, and unequal in size.	(9) Subambulacral spines single and of considerable size.

In the preceding table it will be noticed that use has been made of the width of the marginal plates, a character also used by Fisher (*loc. cit.*, pp. 327 and 328) in separating *incei* from *equestris*, but that author was unable to state at the time whether this character was constant in *equestris*. Little reliance is usually placed on granulation as a distinguishing character, and with only a single specimen of *equestris* before me, I can form no conclusion regarding its value as a specific differential. I have here simply recorded my observations on the available material.

Stellaster princeps, Sladen.

(Plate I, figs. 1 and 2; Plate II, fig. 1.)

Stellaster princeps, Sladen, "Challenger" Zool. XXX, 1889, p. 323, pl. lviii, figs. 1, 2; H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 29.

Locality.—Western Australia (Australian Museum).

Distribution.—Known only from Western Australia and Booby Island, Torres Strait.

Representatives of this species were not obtained with the present collection, and the specimen before me, which is from Western Australia, is mentioned here only because of its importance. According to Clark (*loc. cit.*) the species is known only from the "Challenger" specimens from Booby Island, Torres Strait, and no further record can be found.

The specimen before me, which is undoubtedly *S. princeps*, has five rays: R. = 128 mm.; r. = 45 mm.

The abactinal surface agrees exactly with Sladen's description. Seven longitudinal series of plates occur at the base of the ray, and either three or four midway along that

structure. Conical and sharply pointed tubercles occur on the plates in the positions described, and the almost bare median radial series forms a very striking character.

The number of superomarginal plates (22) is exactly the same as that recorded by Sladen, and they are in complete accord with that author's description.

The spines on the inferomarginal plates evidently vary considerably in number, though in character and arrangement they are constant. Sladen gives three as the usual number of spines to each series, but the following observations on the present specimen show that the number varies.

The inferomarginals at the extreme tip of the ray are destitute of spines. Usually three, sometimes four, spines occur arranged in a lateral position, and in an oblique series on inferomarginal plates near the tip of the ray down to the interbrachial arc. In the interbrachial arc an oblique series of four or five may occur, and sometimes alongside these on the same plate a second series of two may be present, thus making a total of six or seven spines to one inferomarginal plate. The upper or outermost spine is always the longest and broadest; the longest spine measured on the present example is 7 mm.

The adambulacral plates and their armature, together with the two-valved pincer-shaped pedicellariae described as occurring in the immediate vicinity, are exactly as set down by Sladen. Likewise the actinal inter-radial areas and the position of the two-lipped valvate pedicellariae are in complete accord with his description.

Anthenea tuberculosa, Gray.

(Plate V, figs. 4—6.)

Anthenea tuberculosa, Gray, Proc. Zool. Soc. Lond. 1847, p. 77; H. L. Clark, "The Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 29, pl. vi, fig. 1 (and synonymy); H. L. Clark, Rec. Aust. Mus. III, 4, 1928, p. 385.

Localities.—Station XII. 24.ii.1919. Penguin Channel, 10 to 15½ fathoms, rock and shell gravel, mud on edges of pit (1). Station XIV. 7.iii.1929. Half mile S.E. Lizard Island, 19 fathoms, shell gravel, 3 dredges of 20 to 30 minutes each, rich Halimeda (1). Station XXII. 11.iii.1929. To E. of Snake Reef, 13½ fathoms, mud with forams and shells (1).

Distribution.—North Australia round to North Queensland.

Three juvenile specimens in the collection (R. = 22·5 mm., 16 mm., 12·5 mm.) agree so well with Sladen's* figures that I have no doubt as to their identity. Although Sladen was not sure of the identity of his "Challenger" material, Clark (*loc. cit.*) states that in his opinion Sladen was right in naming his specimens *tuberculosa*, Gray.

Oreaster australis, Lütken.

(Plate VI, figs. 1—6; Plate VII, figs. 1—4; Plate VIII, figs. 5—6; Plate X, figs. 1—4.)

Oreaster australis, Lütken, Vidensk. Medd. naturh. Foren. Kjöb. 1871, pp. 253, 263.
Pentaceros australis, Koehler, Echinod. Indian Mus. pt. vi, Asteroidea, 2 (Shallow Water Asteroidea), 1910, p. 93, pl. x, fig. 2; pl. xiii, fig. 1.
Oreaster australis, H. L. Clark, Biol. Res. F. I. S. "Endeavour," IV, 1916, p. 49.
Oreaster hedemanni, Koehler (*loc. cit.*), p. 96, pl. x, fig. 6; pl. xi, fig. 7.

* Sladen, "Challenger" Zool. XXX, 1889, p. 340, pl. lvi, figs. 5–8.

Locality.—Station XIX. 10.iii.1929. About half mile N. of Eagle Island, 10 fathoms, shell gravel, rich Halimeda (6).

A series of twelve specimens collected by the expedition from deep water are referable to this species. In determining the specimens, I have had the use of material collected by the " Endeavour," and named *O. australis* by H. L. Clark.

Earlier authors apparently did not have sufficient material at their disposal to describe the various growth stages of the species, and without this guidance the task of determining the growth stages and individual variation of the present series would have been doubly difficult. A critical study of the present series has led me to the belief that they all belong to the single species *australis* despite obvious differences, all of which I believe to be due to growth or individual variation. On this assumption, I am able to clear up important points concerning two other species of the genus, *gracilis* and *hedemanni*, as well as to attempt to establish more firmly *O. australis*.

I am of the opinion that *O. gracilis* is a distinct species and not merely a form of *O. australis*, as Clark (*loc. cit.*) thought it might be. As regards *hedemanni*, the juvenile specimens in the present series show it clearly to be a synonym of *australis*. Koehler (*loc. cit.*), who examined Lütken's type-specimen of *hedemanni*, gives a full description and excellent figures, and mentions that Lütken himself considered his specimen immature.

Koehler's description and figures fit the small and immature specimens of *O. australis* before me so well that there is no doubt in my mind as to the identity of *hedemanni*.

The following table (p. 249) is an attempt to set out briefly the differences due to growth and variation, together with the points of resemblance found in the members of the present series of *O. australis*. The specimens have been sorted into three sections, each representing a definite growth stage. Six are undoubtedly juveniles, five are young adults, and one is considered an old adult.

Only the specimens collected by the British expedition are dealt with in the following table, as they in themselves form a definite series.

The table will show how unreliable are the tubercles, and to a certain degree the spines of the adambulacral armature, as an aid to determining species even when specimens of approximately the same size are compared. Bell (1884) has made an attempt to define specific limits, but his work does not go far enough. Furthermore, he relies to a considerable extent upon the tubercles to distinguish between species; for example, *O. alveolatus* is said to be identifiable by the constant possession of inferomarginal tubercles (spines). This character, and indeed others relating to size, arrangement, and occurrence of tubercles, are perfectly worthless in my opinion for species such as *O. australis* and *O. alveolatus*. The six adult specimens in the present collection could easily, on such grounds, be split into three seemingly distinct species; but seeing that they all came from the same haul and possess characters in common, apart from the tubercles, such a procedure would, in the light of our knowledge of the Oreasters, be perfectly ridiculous.

Unfortunately, a paper by Döderlein (Zool. Jahrb. Syst., Jena, XL, pp. 409–440, 1916) upon the genus *Oreaster* is not available to me; but it seems perfectly clear that when more material is at hand for study purposes there will be far fewer valid species in the genus and much less difficulty in determining them.

It is quite possible, and even probable, that some authors may consider the specimens in the series before me as referable to *O. alveolatus*. This has not been overlooked, and in

	Juvenile specimens	Young adults.	Old adults.
Rays	(*a*) (Largest specimen) R. = 33·5 mm., r. = 13·5 mm., br. (between 2nd and 3rd superomarginal) 11 mm. R. = 2·4 r. and 3 br.	(*a*) (Largest specimen) R. = 91 mm., r. = 36 mm., br. (between 2nd and 3rd superomarginal) 29 mm. R. = 2·5 r. and 3 br.	(*a*) (The only specimen) R. = 111 mm., r. = 42 mm., br.) between 2nd and 3rd superomarginal) 39 mm. R. = 2·6 r. and 2·8 br.
	(*b*) (Smallest specimen) R. = 20 mm., r. = 7·5 mm., br. (between 2nd and 3rd superomarginal) = 6 mm. R. = 2·6 r. and 3·3 br.	(*b*) (Smallest specimen) R. = 78 mm., r. = 33 mm., br. (between 2nd and 3rd superomarginal) 31 mm. R. = 2·3 r. and 2·5 br.	
	(*a–b*) Ray tapering gradually.	(*a–b*) Rays tapering gradually.	
Disc	(*a*) Normally elevated, not conspicuous.	(*a*) Evenly swollen and elevated.	(*a*) Rays stout and stumpy.
	(*b*) Slightly elevated.	(*b*) Swollen and elevated, mostly centrally.	(*a*) Evenly swollen and well elevated; thick and massive.
Reticulate pattern (on abactinal surface)	(*a*) Becoming discernible.	(*a*) Present, but showing signs of fading, particularly on rays towards extremities.	(*a*) Present on disc; ill defined.
	(*b*) Absent.	(*b*) Well developed and uniformly distributed.	
Papular pores and areas (abactinal surface)	(*a*) Pores 1–9 in number; traces of irregularity in distribution.	(*a*) Pores numerous; areas merging into one another on rays.	(*a*) Pores numerous; areas forming continuous bands on rays and sometimes bounded by the lines of reticulate pattern on disc.
	(*b*) Pores single or paired; arranged regularly.	(*b*) Pores numerous; areas bounded by lines forming reticulate pattern.	
Tubercles:			
1. Pentagon formed by primary radials	(*a*) Well developed, conical and sharply pointed.	(*a*) Large and well developed, conical, though inclined to be bluntly pointed.	(*a*) Large and heavily developed, stumpy and roundly pointed—not strictly conical.
	(*b*) Prominent, sharply pointed and conical	(*b*) Large, well developed and conical.	
2. Granulation of tubercles	(*a*) Evenly clothed except for tip, which is smooth and nipple-like.	(*a*) Evenly clothed except for tip, which is smooth and nipple-like.	(*a*) Evenly clothed, except for tip, which is a bare rounded extremity, or represented by a series of large smooth granules.
	(*b*) Ditto.	(*b*) Ditto.	
3. Tubercles on median radials	(*a*) Present on about half the plates.	(*a*) Present on nearly every plate of series.	(*a*) Present on nearly every plate of series.
	(*b*) Only of isolated occurrence.	(*b*) Present on most plates of series.	
4. Tubercles on other plates of abactinal surface	(*a*) Occur fairly numerously as enlarged granules.	(*a*) Fairly prominent and well developed, arranged in two or three rows and placed at angles of reticulate pattern.	(*a*) Prominent; inclined to be roundly pointed and stubby; in two or three rows, placed at angles of reticulate pattern.
	(*b*) Occur sparingly as large granules.	(*b*) Ill-developed (this character varies in young adults of approximately the same size); arranged in two or three rows and placed at angles of reticulate pattern.	
5. Tubercles on superomarginals	(*a*) Fairly prominent, largest on plates in interbrachial arcs and near extremities of rays.	(*a*) Fairly well developed, though mostly confined to plates in interbrachial arcs and near tips of rays.	(*a*) Wanting.
	(*b*) Present, though small, largest on plates near extremities of rays.	(*b*) Wanting (young adults between sizes *a* and *b* are all provided with fairly well-developed tubercles.)	
6. Tubercles on inferomarginals	(*a*) Comparatively well developed, especially near tips of rays.	(*a*) Occur sparingly on plates in interbrachial arcs and near tips of rays.	(*a*) Wanting.
	(*b*) Present only on plates near tips of rays. Here they are very prominent and comparatively large for the specimen.	(*b*) Conspicuous, confined mostly to plates in interbrachial arcs.	
Number of superomarginals	(*a*) 15–16.	(*a*) 18.	(*a*) 19–12.
	(*b*) 12.	(*b*) 16–17.	
Number of inferomarginals	(*a*) 15–16.	(*a*) 19–20.	(*a*) 20.
	(*b*) 12.	(*b*) 18.	
Pedicellariae:			
1. Low bivalved slit-like	(*a*) Present both surfaces.	(*a*) Present both surfaces; rare on abactinal surface; small.	(*a*) Present both surfaces; comparatively conspicuous.
	(*b*) ,, ,, ,,	(*b*) Present both surfaces; very minute; rare on abactinal surface.	
2. Upright forceps pedicel	(*a*) Present both surfaces; rare on abactinal surface; confined mostly to ambulacral furrow actinally.	(*a*) Present both surfaces; confined to ambulacral furrow actinally.	(*a*) Present both surfaces; fairly numerous abactinally and confined to ambulacral furrow actinally.
	(*b*) Absent (so far as can be made out).	(*b*) Ditto.	
Adambulacral armature (furrow spines)	(*a*) 6–8.	(*a*) 8–10.	(*a*) Usually 8. The series is entirely hidden by the subambulacral spines.
	(*b*) 6–7.	(*b*) 8–10.	
Subambulacral spines	(*a*) 1–3.	(*a*) 2–3.	(*a*) 2–3.
	(*b*) 1–3.	(*b*) 2–3.	

order to ascertain the differences between that species and *O. australis*, I have used specimens named by H. L. Clark as *O. australis*, Koehler's description and figures of *O. australis*, and three specimens from New Caledonia attributed mainly on the ground of the locality to *O. alveolatus* which are in the collections of the Australian Museum (see figure of one; R. = 90 mm.) I can find no tangible differences to separate any of them. This would point to the conclusion that *O. alveolatus* is a synonym of *O. australis*—a conclusion which, in my opinion, the study of further material will substantiate. Scarcely any of the descriptions and figures of *O. alveolatus* wholly agree with one another. Even the specimens before me from New Caledonia cannot be said to agree very well with any existing records.

In order to make perfectly clear the character of the specimens upon which the preceding table and notes are based, as many as reasonably possible have been figured.

Oreaster nodosus (Linnaeus).

Asterias nodosa, Linnaeus, Syst. Nat., ed. X, 1758, p. 661.
Oreaster nodosus, Fisher, Bull. U.S. Nat. Mus. 100, III, 1919, p. 346, pl. cii, fig. 2 (and synonymy).

Locality.—Gen. Survey; 23.4.1929, Western Moat (1).

Distribution.—Region of Indian Ocean, East India Islands (north to Luzon), thence to New Caledonia and N.E. Australia in the Pacific.

Only a single specimen of this species was collected by the expedition. Specimens in the Australian Museum collection show the species to be fairly common in and around Port Denison, Queensland, where it lives between tide-marks during the winter season; it retires in the summer months to deeper water to avoid the severe seas of the monsoonal weather.

The colour is extremely variable, according to the careful colour notes taken by E. H. Rainford, of Bowen, Queensland, who states that the predominating colours are crimson and white.

The specimen from Low Isles before me is a juvenile measuring R. 39 mm.

Culcita novaeguineae, Müller and Troschel.

(Plate III, figs. 2 and 4; Plate IV, figs. 3 and 4.)

Culcita novaeguineae, Müller and Troschel, Syst. der Asteriden, 1842, p. 38; Goto, J. Coll. Sci. Tokyo, XXIX, Art. 1, 1914, p. 519, pl. xvii, figs. 252–262; H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 32, pl. v, fig. 1.

Localities.—Low Isles, Gen. Survey, mud flat (adults). (Juvenile specimens were collected under stones in vicinity of Western Moat and Southern Moat, Rampart Y, 6.iv.1929 (7).)

Distribution.—Torres Strait and Queensland Coast; from Mozambique to Society Islands, and northward to the Andaman Islands, and to Kagoshima, Japan.

With the exception of the well-known *L. laevigata*, this species was as common as any other asteroid at Low Isles. Clark* records this species from "The Great Barrier Reef, Queensland," being unable to give a precise locality. He states that "if the locality were in the vicinity whence most of the present collection came" (between 17° and 19° S. lat.) "it would be a notable extension to the range of the genus." The present record,

* H. L. Clark, Rec. Aust. Mus. XV, 1926, p. 185.

then. establishes the fact that the species occurs in the immediate vicinity of the area mentioned by Clark.

The youngest examples were found sheltered in reefs of dead and living coral, while the older ones were usually discovered on the open flat at low tide in about one to three feet of water. The two youngest specimens of the series of six before me bear a striking resemblance to those figured by Koehler,* and the remaining four agree with the key given by Goto (*loc. cit.*).

In the more mature specimens of the present series both the poriferous and net-like non-poriferous areas bear spiniform tubercles, which are noticeably bigger on the last-mentioned area. In the largest specimen. which is about half grown, some of the spiniform tubercles on the poriferous areas are as big as those on the non-poriferous areas, but as this character is not seen on younger examples it is obvious that it is due to age. The marginal zone is destitute of papulae—a feature most plainly visible on the largest specimen before me.

On the largest specimen five conspicuous humps of irregular shape occur in a more or less regular situation in the centre of the abactinal surface. Each is situated above and midway between the upturned extremities of the ambulacral furrows. The tops of the humps are seen to be constituted by extremely well-developed and thickened non-poriferous areas, and the humps themselves are produced by the sinking of the weaker surrounding non-poriferous areas during the process of drying and contracting. Younger examples show a thickened series of non-poriferous areas extending from near the margin midway between the rays up to the centre of the abactinal surface, but apparently these are not sufficiently developed to cause humps when dry and contracted.

In the youngest example the actinal plates are conspicuous. Each is clothed in granules, but those in the centre of each plate are much larger and coarser than their surrounding fellows. The large granules number from three to twelve. The whole series of specimens shows that, as the adult condition approaches, the well-defined areas of granules on the actinal surface become more indistinct, and in the largest example the grouping of the granules in the centre of each plate is almost indiscernible. Age does not seem to affect the number of inner adambulacral spines, which vary from five to six in each group, both in the smallest and largest example.

Of the varieties of the species, the present specimens seem to be nearest to var. *acutispinosa*, on account of the continuous poriferous areas, especially near the margins, but the abactinal surface cannot be said to be covered by the numerous coarse spines described as occurring on that variety.

Asterope carinifera (Lamarck).

Asterias carinifera, Lamarck, Anim. s. Vert. II, 1816, p. 556.
Asterope carinifera, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 33, pl. v, fig. 2.

Localities.—Gen. Survey ; Low Isles, Western, Southern and Middle Moats (2).

Distribution.—Indo-Pacific. "It ranges from Mozambique, Zanzibar, and the Red Sea on the west, to the Hawaiian and Society Islands on the east, and from Queensland and New Caledonia on the south to Okinawa, Riu-kiu Islands on the north. It is

* Koehler, Echinod. Indian Mus. pt. vi, Asteroidea 2 (Shallow Water Asteroidea), 1910, pl. ix, figs. 4, 5.

also reported from the Galapagos Islands, Panama, and La Paz, Lower California, but these records are all old and need verification" (H. L. Clark, 1921).

The specimens collected or seen on the reefs of sand and coral were all of a very dark chocolate hue. As stated by Clark (*loc cit.*), some difficulty was experienced in seeing them, as their colour rendered them inconspicuous.

Fromia milleporella (Lamarck).

Asterias milleporella, Lamarck, Anim. s. Vert. II, 1816, p. 564.
Fromia milleporella, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 40.

Locality.—Low Isles (1).

Distribution.—"Red Sea, Mauritius, Madagascar, Ceylon to Samoa and Fiji Islands, *via* the Moluccas and Southern Philippines; New Caledonia; also Riu-kiu Islands, Japan" (Fisher, 1919). Mer, Torres Strait (H. L. Clark, 1921) and Low Isles, Queensland.

Prior to 1926, this species was not known from the mainland coast of Australia. Clark,* in that year, recorded six specimens from Coates Reef, Outer Great Barrier Reef, between 17° and 19° S. lat. The present record extends the range some little distance northward from that locality.

Only a single specimen exists in the present collection, and it was found among dead and living coral between tide-marks. The specimen was apparently mutilated at an early age, as two of the five arms are extremely short. R. = 3·4 r. and 3·1 br. Only one madreporite is present, but, after comparing the specimen with Queensland examples in the Australian Museum identified by H. L. Clark, I have no doubt as to its identity.

Nardoa pauciforis (von Martens).

(Plate III, fig. 3; Plate IV, fig. 6.)

Linckia pauciforis, von Martens, Arch. Naturgesch. XXXII, pt. 1, 1866, p. 69.
Nardoa pauciforis, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 51 (and synonymy).

Localities.—Gen. Survey, Low Isles; found exposed on reefs of dead and living coral between tide-mark (2). Batt Reef, off Port Douglas, N. Queensland; in same habitat as above (3).

Distribution.—Flores, Philippines, Amboina, Queensland, Erub and Mer, Torres Strait.

The discovery of this species at Low Isles and Batt Reef is not remarkable, as it has already been collected at Green Island, near Cairns, and at localities in Torres Strait (*fide* Clark, *loc. cit.*). The present record merely links up these areas.

The species was noticeably common both at Low Isles and Batt Reef, and is, as noted by Clark, extremely sluggish, the individuals observed making no attempt to hide for protection or to avoid the hot sunshine. Of the five selected specimens before me the one with R. = 95 mm. is the largest. The papulae in each area vary considerably in number, and the comparative smallness of the abactinal plates is noticeable. In the

* H. L. Clark, Rec. Aust. Mus. XV, 1926, p. 185.

largest example the number of abactinal plates across the base of the ray between the two superomarginal series comes within the limit (12–13) set by Clark. In some cases, however, the number increases to fourteen, while in the smallest example (R. = 74 mm.) only eleven are to be counted.

The colour in life of the species agrees well with Clark's description.

Nardoa novaecaledoniae (Perrier).

(Plate IV, fig. 1 ; Plate V, fig. 3.)

Scytaster novaecaledoniae, Perrier, Archiv Zool. Exp. Gén. IV, 1875, p. 426.
Nardoa novaecaledoniae, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 52 (and synonymy).

Locality.—Low Isles ; found exposed on reef of dead and living coral between tide-marks (1) ; Yonge Reef, Inner Moat, 6th June, 1929 (1).

Distribution.—Mer, Torres Strait, Queensland, New Caledonia, Philippines, Andaman Islands, Maldives (? Minikoi and New Ireland), Ceylon, Moluccas.

A single four-rayed specimen of this species was handed to me, by a member of the collecting party, as an abnormal *N. pauciforis*. By the colour and shape of the specimen one could easily mistake it for its commoner ally, and the confusion was not noticed by any of us until after a later and more careful examination had been made. The likeness in colour of the two species has been already recorded by Clark (*loc. cit.*), who examined specimens from Green Island, near Cairns, and Mer, Torres Strait, where both species were found to occur together. R. = 81·5 mm. in the present example. The abactinal plates are not crowded on the disc or on the basal end of the rays, and in both of these areas the plates range from 2 to 4 mm. in diameter. Running from about the middle of the ray towards the distal or free extremity, the abactinal plates are seen to become more crowded, with the result that, at, and near the extreme tip, they are very numerous, small, and densely packed together. The abactinal plates on the extremities of the rays are, like those on the disc and basal ends of the rays, provided with conspicuous central granules.

Nardoa rosea, H. L. Clark.

(Plate VIII, fig. 7.)

Nardoa rosea, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 53, pl. x, fig. 1 ; pl. xxix, figs. 1, 2.

Locality.—Station XX. 10.iii.1929. About $\frac{1}{4}$ mile N. of Eagle Island, 6 fathoms, coral (1).

Distribution.—Known only from Australian waters. Murray Islands, Torres Strait ; Eagle Island, Queensland ; Heron Island, Capricorn Group, Queensland.

This sea-star is not common, as past and present records show. Further, I have never seen it alive on any part of the Great Barrier Reef that I have visited.

The single specimen collected by the expedition has its rays very much distorted but the R. is calculated to be about 72 mm. It agrees perfectly with the original description and shows no variation.

That adult specimens do not vary is confirmed by another specimen in the Australian Museum from Heron Island, Capricorn Group, Queensland. This specimen is also responsible for the extension of the known range of the species to a considerable distance south of Low Isles.

Linckia guildingii, Gray.

Linckia guildingii, Gray, Ann. Mag. Nat. Hist. VI, 1840, p. 285 ; H. L. Clark, " Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 67.

Locality.—Yonge Reef, Outer Barrier, Inner Moat, 5.vi.1929 (1).

Distribution.—Almost circum-tropical. See Clark (*loc. cit.*) for complete range.

With characteristic clarity Clark has provided a means by which this species can be readily recognized. The single specimen before me is labelled the " Brown Linckia," together with the information that " it was nearly this colour " (dull grey-brown as described by Clark for dry specimens) " when alive—no blue." This, with other characters of a structural nature, leaves no doubt as to the identity of this specimen.

Although large (R. = 125 mm.) the specimen is by no means of a record size, for Clark refers to a specimen from Bermuda with R. = 215 mm.

Although only one specimen of the species was secured, T. A. Stephenson, a member of the expedition, informs me (*in litt.*) that the species was " very common on Yonge and Ribbon Reefs."

Linckia laevigata (Linnaeus).

(Plate III, fig. 1 ; Plate IV, figs. 2 and 5.)

Asterias laevigata, Linnaeus, Syst. Nat., ed. x, 1758, p. 662.
Linckia laevigata, H. L. Clark, " Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 64, pl. ix, figs. 1, 2 ; pl. xxvi, fig. 1 (and synonymy).

Locality.—Low Isles ; exposed on reefs of dead and living coral between tide-marks, especially on Fungia and Madrepore Moats (4).

Distribution.—See H. L. Clark, 1921, p. 65, for detailed and complete information.

This handsome blue species was the commonest and most conspicuous sea-star both on Batt Reef and Low Isles, but examples from only the last-mentioned locality were collected. The largest of the four specimens collected has R. = 157 mm. and the smallest R. = 56·5 mm. It is noticeable that the two smallest examples, although showing little difference in ray measurement, exhibit a comparatively marked difference in the breadth of these structures. The individual mentioned above with R. = 56·5 mm. has br. = 13 mm., while the second smallest has R. = 63·5 mm. and br. = 10 mm. Although the difference in breadth is only 3 mm. it is considerable, if we take into account the almost equal length of the rays. When the two specimens are compared, the rays of the smaller specimen could be properly described as stumpy and fairly thick, while those of its slightly larger fellow should be called slender.

Clark (*loc. cit.*) showed that this type of variation is not unknown in the species, but, in his view, it occurred only when the specimens were from different localities. The present record demonstrates that such variation can take place in specimens from the same locality.

Ophidiaster propinquus, sp. nov.*

(Plate XII, figs. 5, 11, 16, 18.)

Locality.—Ribbon Reef, 4.vi.1929 ; seaward sloping zone (1).

Description.—R. = 26·5 mm. ; r. = 5·5 mm. ; br. (at base of ray) = 5 mm. R. = 4·8 r. and 5·03 br. Disc distinct, though not prominent. Rays slightly unequal in length, semicircular abactinally, and flat, or nearly so, actinally. The width of the rays changes little throughout their entire length, the slight taper becoming noticeable only upon close examination. The plates of the abactinal surface are arranged in more or less regular order, especially near and at the margins, where a shallow though well-marked furrow separates them longitudinally. Mid-dorsally, however, the various series of plates become slightly disarranged and tend to intermingle with one another.

The marginal plates of both series are well marked, much more so than those near the top of the abactinal surface. The granulation of the abactinal surface is even. Only the plates of the marginal series bear larger granules centrally.

The papular areas are not clearly defined, nor arranged with any regularity except near the marginals. The number of papulae to an area varies from 1–7. The papulae are scarce on the abactinal surface of the disc, where they usually occur singly or in pairs. The areas are not, on the whole, deeply sunken.

The terminal plate is slightly over 1 mm. across. It is bare, and in one case sparsely pitted. The madreporite is smooth, well channelled, and measures 1 mm. in diameter.

The plates of the actinal surface are arranged in a very regular series. Three series of actinolateral plates occur. The actinal plates are much coarser in their granulation than the plates of the abactinal surface, and moreover, their central areas bear granules of comparatively large size.

The furrow spines are arranged two to a plate. They are of equal size and definitely club-shaped. Each pair of spines, not each individual spine, is separated from its adjoining fellow pair by small granules varying in number from one to three. Usually three granules occur. At the back of the furrow series, and separated from it and from one another by one or two rows of small granules, are two rows of blunt, stumpy, spine-like tubercles, two of which correspond to three furrow spines. The spine-like tubercles of the outer row, although smaller, correspond to those of the first or inner row. Outside the second series there occur occasionally further spine-like granules or tubercles, which, although merging in some cases into the spine-like tubercles of the second series, are usually separate, and not arranged in any continuous regular order.

No pedicellariae.

Colour.—Pale biscuit yellow with darker blotches abactinally (specimen dried after a short preservation in alcohol).

Affinities.—The closest known relative of this species appears to be *O. squameus* Fisher. *O. propinquus* has been compared with a specimen of *O. squameus* from Mer, Murray Islands, Torres Strait, kindly lent by H. L. Clark, together with Fisher's original description and figures. The characters found separating *O. propinquus* from *O. squameus* are as follows: Papular areas and pores not conspicuous. Plates not markedly convex. Granules not coarse; those covering abactinal plates never noticeably enlarged centrally.

* Specific name indicates the species' affinity with *O. squameus*, Fisher.

Granules occur between each *pair* of furrow spinelets, not between each spinelet. *Two* rows of granule-like tubercles outside furrow series. No granules with the appearance of scales.

Tamaria, Gray.

Tamaria, Gray, Ann. Mag. Nat. Hist. VI, 1840, p. 283.

This genus has, in recent years, been subjected to a comparatively brief overhaul, but lack of material, coupled with scanty and sometimes contradictory information, has seriously hampered workers in deciding on the validity of its various species. Even the genus cannot be said to be secure in its present status.

A study of material on loan from the Museum of Comparative Zoology, Cambridge, Mass., U.S.A., of material secured by the expedition, photographs of authentic material in the British Museum (Nat. Hist.) and specimens in the Australian Museum has led me to the following main conclusions:

That *T. fusca*, Gray, is not a very variable species, and that, in Australian waters at least, it is distinct and easily recognizable.

That the genus *Tamaria* is of doubtful validity.

That many specimens associated with *T. fusca* by earlier authors belong to distinct species.

That Bell's records of species are unreliable owing to his errors in identification.

That Sladen's *tuberifer* should be relegated to the synonymy of Bell's *megaloplax* on the ground of priority.

That distinct species occur in the same zone.

That the species of the Queensland coast are distinct from those at present known to occur in western and north-western waters of the Continent.

In brief, I believe the status of the various species mentioned to be as follows:

(a) *Tamaria fusca*, Gray. Valid.

(b) *Tamaria fusca* (Fisher's 1919 specimens). From available information they are identical with Gray's specimen.

(c) *Tamaria fusca* (Perrier's record). Valid. (Gray's specimen used.)

(d) *Tamaria fusca* (Studer's "Gazelle" specimens labelled *O. fuscus* and mentioned by Clark, 1921) referable to *T. hirsuta*, Koch.

(e) *Tamaria* sp. Bell's Zanzibar material. Most certainly not *Tamaria fusca*, Gray.

(f) *Tamaria fusca* (Clark's 1921 Holothuria Bank specimens). Not *T. fusca*, Gray, but the two species described by Koehler—*ornata* and *hirsuta*.

(g) *Tamaria lithosora*, H. L. Clark. Valid ?

(h) *Tamaria megaloplax*, Bell (Bell's specimens from Holothuria Bank). See Clark's reference to these specimens under (f).

(i) *Tamaria megaloplax*, Bell. Valid. ("Alert" specimen from Albany Island.)

(j) *Tamaria ornata*, Koehler. Valid.

(k) *Tamaria hirsuta*, Koehler. Valid.

(l) *Tamaria tuberifera*, Sladen ("Challenger" and subsequent material), in the synonymy of *T. megaloplax* Bell (Albany Island specimen).

Tamaria fusca, Gray.

(Plate IX, figs. 4—7; Plate XI, figs. 1, 2, 3, 4, 7, 8; Plate XII, figs. 1, 4, 6, 7, 10, 15, 17, 19.)

Tamaria fusca, Gray, Ann. Mag. Nat. Hist. VI, 1840, p. 283.
Ophidiaster fuscus, Perrier, Arch. Zool. exp. gén. 1875, p. 396; Fisher, Bull. U.S. Nat. Mus. 100, 1919, p. 388, pl. xcv, figs. 5, 5*a–c*; pl. ciii, fig. 4; pl. civ, fig. 1; pl. cxi, figs. 5, 6.
Tamaria fusca, Livingstone, Rec. Aust. Mus. XVIII, No. 1, 1930, p. 22, pl. viii, figs. 2–5.

Localities.—Station XVI, 9.iii.1929: about ½ mile W. of N. Direction Island, 20 fathoms, stony, five juveniles: Station XIV, 7.iii.1929; ½ mile S.E. Lizard Island, 19 fathoms, shell gravel, rich Halimeda, one juvenile; off Lindeman Island, Whitsunday Passage, Queensland, 9 fathoms, 1929, 1 specimen possibly adult, Austr. Mus. (this specimen was recorded and figured by me in a previous paper); Port Denison, Queensland, one seemingly half-grown example, Austr. Mus.

Distribution.—Philippine Islands, Celebes and coast of North Queensland (other records exist, but I believe the specimens were incorrectly identified).

Photographs of Gray's type of *fusca* kindly supplied by the authorities of the British Museum (Nat. Hist.) have enabled me to establish definitely the status and characters of the species. In the past errors have been made in identification owing to the lack of definite information and other causes. In order to avoid or reduce further complications the photographs before me have been reproduced in this work.

The species has the reputation of being one of the most variable in the family. This is, I think, not wholly warranted, as all the specimens available to me, which collectively form a good series illustrating growth stages, point to an opposite conclusion. Fisher (1919) and Clark (1921) have, in my opinion, relegated too much to the synonymy of *fusca* and assumed too much variation.

Six juveniles before me are undoubtedly referable to *fusca*, and none of them is similar to specimens previously regarded as young or immature examples of *fusca*. Further, the young of *fusca* are easily recognized and associated with the adult.

Fisher's (1919) specimens from the Philippines and Celebes are referable to *fusca*, and the information concerning them was used in determining a specimen from Whitsunday Passage, Queensland, dealt with in an earlier paper (*loc. cit.*, 1930). I see no reason to question that determination after examining photographs of Gray's type. A study of this specimen together with a smaller one in the collections of the Australian Museum and of the juveniles collected by the expedition has caused me to review and alter the synonymy submitted tentatively by H. L. Clark. *Linckia megaloplax*, Bell (Albany Island specimens and Holothuria Bank specimens) should have no place in the synonymy of *fusca*. *O. ornatus* and *O. hirsutus* of Koehler are apparently distinct species. The specimens available to me suggest that Koehler was justified in separating the two forms from one another and from *T. fusca*.

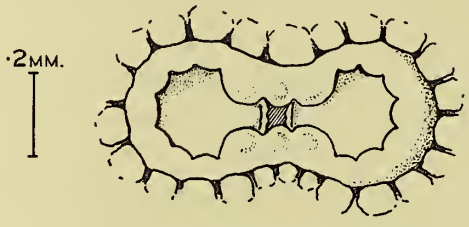
A "Gazelle" specimen, the property of the Museum of Comparative Zoology, Cambridge, Mass., U.S.A., named *Ophidiaster fuscus* by Studer and referred to by Clark (1921) under the heading of *Tamaria fusca*, is before me. I am convinced it does not belong to Gray's species, but is referable to *T. hirsuta*, Koehler. Further mention of it is made under that heading.

After examining photographs of specimens of Bell's supposed *O. fuscus* from Zanzibar I find that they do not represent examples of *fusca* of Gray, and am at a loss to place them.

They may be related to specimens identified and listed by Simpson and Rudmose-Brown (1910) as *Linckia marmorata*. The photographs have been reproduced for the benefit of future workers wishing to investigate the question of the African examples, as well as to support my opinion as to the status of Bell's material.

Description.—Rays five (measurements given under the heading of material examined). Disc noticeably elevated. The rays taper evenly and rapidly from base to a comparatively sharp point. In a large specimen (R. = 50 mm.) the papular areas are, as usual, arranged in six regular rows. They are small and deeply sunken between the prominent rows of abactinal plates. The papular pores number from 1–9. The areas containing the greatest number of pores are situated near the base of the ray and on the disc. Smaller specimens possess from 1–4 and 1–6 pores to an area. The papular areas situated on either side of the median series of plates do not reach the tip of the ray, and therefore only four series of areas can be counted in that region. This character can also be observed in juvenile examples. It was also described by Clark (1921) for *T. lithosora*.

The abactinal plates are noticeably elevated, even in young examples. The plates on the disc are the largest to be found. All abactinal and superomarginal plates are clothed by densely packed granules, among which here and there occur larger and more



Text-fig. 1.—*Tamaria fusca*, Gray. Pedicellaria drawn from Gray's type specimen.

conspicuous granules of a smooth and bald nature. These larger granules occur in the centre of the plate. They number from 2 to 15 to a plate, and are similar to those described by Clark as occurring in *T. lithosora*. The granules between the papular pores are very uneven in size.

The terminal plate is hemispherical and smooth.

The madreporite is elevated and prominent.

The pedicellariae are particularly prominent and plentiful in juvenile examples of the species.

The inferomarginal plates, although densely clothed in small granules, are destitute of the large and bald granules characteristic of the superomarginal and abactinal plates, and bear instead, in almost every case, a central blunt spine or tubercle.

Two series of actinolateral plates occur.

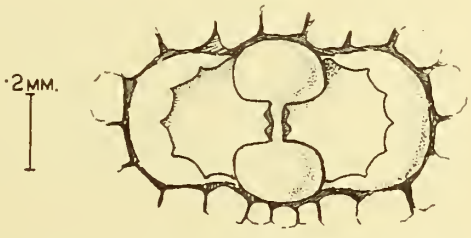
The furrow spines number two to a plate. No granules occur between these spines. Behind the furrow series is a single series of prominent ovoidal spine-like granules, which are spaced much closer together in the region of the mouth than anywhere else.

Material Examined.—Eight specimens. Six juveniles with R. ranging from 7 mm. to 17 mm. (Brit. Exp. Coll.); one apparently half-grown specimen, R. = 30·5 mm., and one seemingly fully grown adult, R. = 50 mm. (Austr. Mus. Coll.); this latter specimen was figured by me in a previous paper (1930).

Colour.—Only the largest specimen shows the brown and "Bougainvillea" purple

markings. The other examples have been preserved in alcohol and have lost all their natural colours.

Affinities.—The only species to which *fusca* can now be regarded as closely related is *T. lithosora*, H. L. Clark. Judging from Clark's description and figures (1921), I was at first inclined to place *lithosora* into the synonymy of *fusca*, but before doing so more information was sought from Clark. Being unable to send me his type for examination Clark kindly supplied the following information (*in litt.*): "With regard to my species *lithosora*, I have just compared the type with Fisher's figures of *fusca* and the difference between them is very marked . . . in *lithosora* the tubercles are very rounded and smooth and not in the least like tubercles or small spinelets such as one sees in *fusca*. I might add that in *lithosora* on the oral surface there is a very complete series of subambulacral spines, which give the furrow a very different appearance from what I have seen either in specimens or figures of *fusca*." Clark admits, however, the possibility of his *lithosora* being only an extreme form of *fusca*, but until his specimen is examined more critically and compared with authentic material of *fusca*, one cannot arrive at a very definite and satisfactory conclusion.



Text-fig. 2.—*Tamaria megaloplax* (Bell). Pedicellaria drawn from Bell's specimen of *Linckia megaloplax* from Albany Island; Alert Expedition.

Tamaria megaloplax (Bell).

(Plate IX, figs. 1—3; Plate XII, figs. 8, 12, 14.)

Linckia megaloplax, Bell, Rep. Zool. Coll. "Alert," 1884, p. 126 (Albany Island specimen).

Ophidiaster tuberifer, Sladen, "Challenger" Zool. XXX, 1889, p. 404, pl. lxv, figs. 1–4; Döderlein (in Semon), Zool. Forschungsreisen in Aust. V, 1896, p. 317; Koehler, Echinod. Ind. Mus. VI, Asteroidea, 2 (Shallow Water Asteroidea) 1910, p. 148; Fisher, Bull. U.S. Nat. Mus. 100, 1919, p. 393.

Tamaria tuberifera, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 90, pl. viii, fig. 1; Livingstone, Rec. Aust. Mus. XVIII, No. 1, 1930, p. 22, pl. iv, fig. 3; pl. viii, figs. 1, 3, 4.

Locality.—Station XXII, 11.iii.1929. To East of Snake Reef, 13½ fathoms, mud with forams and shells (1).

Distribution.—Coast of Queensland, Torres Strait, Andaman Islands and Philippines.

A set of photographs of Bell's original Albany Island specimen ("Alert" Coll.) of *Linckia megaloplax* is before me. There is no doubt that Sladen's *Ophidiaster tuberifer* is the same species. It is most unfortunate that such a well-known name as *tuberifer* should be sunk as a synonym in favour of Bell's hitherto somewhat uncertain name, but as Bell's species has priority, there is no alternative. Specimens from Fitzroy Island, Port Curtis and Port Denison, Queensland, were also included by Bell under his original description of *megaloplax*, but only the specimen from Albany Island can be regarded as authentic at present. These remaining specimens may or may not belong to one species—the uncertainty arising from the apparent laxity with which Bell appended names.

Bell's description certainly fits the photographs of the Albany Island specimen, and I see no reason for designating any other specimen from the mixed batch he had before him as the type of Bell's species. Other specimens erroneously named *megaloplax* by Bell (Holothuria Bank material referred to by Clark, 1921) do not belong here, and have been dealt with later under separate headings.

It is interesting to be able to confirm Clark's surmise (1921, p. 90) that *T. tuberifera*, Sladen, is really Bell's Albany Island *megaloplax*.

Only one specimen of the species is in the expedition's collection, R. = 31·5 mm.

Tamaria hirsuta (Koehler).

(Plate X, figs. 5—7 ; Plate XI, figs. 9 and 10 ; Plate XII, fig. 20.)

Ophidiaster hirsutus, Koehler, Echinod. Ind. Mus. VI, Asteroidea, 2 (Shallow Water Asteroidea), 1910, p. 149, pl. xviii, figs. 5, 6 ; Fisher, Bull. U.S. Nat. Mus. 100, 1919, p. 388.

Tamaria fusca, H. L. Clark (*non* Gray), "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 89 (part), pl. xxviii, figs. 1, 2.

Distribution.—Andaman Islands and Holothuria Bank off north-west Australia.

I have before me on loan one of the specimens from Holothuria Bank identified by Bell as his *megaloplax* and referred to by Clark (*loc. cit.*) as Koehler's *hirsutus*. In the first place I am reasonably confident that Bell's identification was incorrect, and that the Holothuria Bank specimens are not conspecific with Bell's *megaloplax* from Albany Island. Secondly, I venture to disagree with both Fisher and Clark as to the status of *hirsuta*. In differing from the more mature opinion of these authorities I submit that the photographs of *hirsuta* and *fusca* in this work are of specimens of distinct species.

T. hirsuta seems to be closer to *megaloplax* than to *fusca*, but here also there are differences, and I prefer to await more evidence before dropping the specific name, *hirsuta*. Lastly, greater reliance should be placed on Koehler's judgment, as he was doubtless aware of the existence of *fusca*, *tuberifera* and *megaloplax*, even though they were then only imperfectly known ; and he would presumably have taken them into consideration before establishing a new species for his specimen. In any case the specimens and photographs before me seem to justify Koehler's action. I include under these species Studer's "Gazelle" specimens, one of which was referred to by Clark (1921) as *T. fusca*. Clark's specimen is before me on loan, and I am confident it should not be attributed to *T. fusca*. One other specimen, in the collection of the Australian Museum, also belongs here. It has R. = 26 mm., and is accompanied by a label bearing the locality "Western Australia." It is identical with Studer's specimen before me. In conclusion it may be pointed out that the species of *Tamaria* from the north and north-west coasts of Australia have, so far as is known, no representatives on the Queensland coast, and conversely ; therefore no overlapping of species is believed to occur.

Tamaria ornata (Koehler).

(Plate XII, fig. 2.)

Ophidiaster ornatus, Koehler, Echinod. Ind. Mus. VI, Asteroidea, 2 (Shallow Water Asteroidea), 1910, p. 151, pl. xviii, figs. 3, 4.

Tamaria fusca, H. L. Clark (*non* Gray), "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 89 (part).

Distribution.—S. coast Ceylon and Holothuria Bank off north-west Australia.

I have before me a second specimen from Holothuria Bank (R. = 22 mm.) labelled by Bell as his *megaloplax* and considered by Clark closely to resemble the type of Koehler's *ornatus*. Clark, through whom the present specimen was secured on loan, considered it referable to *fusca*, and reduced *ornatus* to the synonymy of that species. The specimen, however, shows characters which serve instantly to separate it from *fusca*, and as it cannot be reasonably referred to any other species of the genus, one must regard it as representing a distinct species.

Tamaria sp.

(Plate XI, figs. 5, 6, 11, 12; Plate XII, figs. 3, 9, 13.)

Localities.—12 fathoms, Fitzroy Island, Queensland (smallest specimen); Port Curtis, Queensland, 12 fathoms (Austr. Mus. specimens).

In order to review all the material available to me, I have included under this heading three further specimens in the collections of the Australian Museum. The smallest specimen has R. = 29 mm., and is from 12 fathoms off Fitzroy Island, Queensland. This is one of Bell's localities for some of the examples of *megaloplax* gathered by the "Alert," but I have no reason to believe that the present specimen was secured by that expedition. A slightly larger specimen, R. = 34 mm., was collected recently in Port Curtis, Queensland, in a depth of 12 fathoms together with a further specimen, the largest of the three, with R. = 103·5 mm. Port Curtis is another of the localities of *megaloplax* given by Bell in his "Alert" report. All three specimens seem to be closely related and possibly referable to the one species. They are most certainly not referable to Bell's *megaloplax*, as they might be in view of the localities from which they came. Either of the two smallest specimens at first sight might be taken for the young of *megaloplax*, but comparison shows that *megaloplax*, even in the young stage, possesses definite roundly rectangular and large papular areas which are not deeply sunken, whereas the two small Tamarias under discussion have very small and sunken papular areas. The papular areas themselves furnish a very reliable means of distinguishing species of the genus.

The largest specimen is by far the most interesting, as it seems to alter one's views in regard to the status of the genus *Tamaria*. It has been compared with examples of *Hacelia helicosticha*, Sladen, to which it appears to be closely related.

The salient feature regarded as distinguishing *Tamaria* from *Ophidiaster* is the number of rows of papular areas, yet it is known that the former genus approaches the latter in the occasional presence of isolated papulae on the actinal surface immediately below the inferomarginals. Although these additional papulae have been considered by H. L. Clark to be unimportant as generic characters, their presence in greater numbers than ever known before raises the question of their differential value and of the limits of the two genera. The large specimen before me appears to possess characters intermediate between those of *Ophidiaster* and *Tamaria*. It cannot be referred to any of the known species of *Tamaria*, and, indeed, it is uncertain whether it belongs to the genus, although I have provisionally placed it there. On the other hand, if it were not for the unusually large number of papular pores below the inferomarginals the specimen could be regarded as agreeing in many respects with *T. scleroderma*. There are, however, important characters other than the papular areas which instantly separate the latter species from that represented by my specimen. The general form of the body and rays alone are sufficient.

The two smaller specimens possess only six series of papular areas. The larger of the two is the more likely to be the young of the largest specimen. The extra series of papular areas obviously becomes manifest with age. Pedicellariae occur on the three specimens, and resemble those found on *T. megaloplax*.

All three have been figured in detail in order to assist future workers on this difficult group.

Nepanthia (*? brevis*) (Perrier).

(Plate V, figs. 8 and 9.)

Asterina (*Nepanthia*) *brevis*, Perrier, Arch. Zool. Exp. Gén. V, 1876, p. 241.
Nepanthia brevis, Sladen, "Challenger" Zool. XXX, 1889, p. 387, pl. lxiii, figs. 3–5; H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 95, pl. vi, figs. 3, 4.

Locality.—Dredged 8 fathoms N.E. of Low Isles, mud and stones, September, 1928 (1).

Distribution.—Torres Strait and North-west Australia (Philippines and N. Queensland doubtful).

I refer with some hesitation this single specimen to the above species. Several species of the genus, including *brevis*, are ill defined, and their descriptions confusing. Fisher (1919) had difficulty in deciding whether one of his specimens belonged to *joubini*, Koehler, or whether it was a six-rayed example of *brevis*. The specimen before me resembles that of Fisher and I find a similar difficulty in its attribution.

The Australian Museum specimens of the genus are at present on loan to H. L. Clark, who intends to make a detailed study of them in conjunction with other material and to publish the results of his work. Without this material I am unable to make comparisons with the present specimen, but to avoid confusion as to its nature two illustrations of it are given.

The specimen possesses five madreporites. R. = 34 mm., r. = 10 mm., rays curled.

Patiriella exigua (Lamarck).

Asterias exigua, Lamarck, Anim. s. Vert. II, 1816, p. 554.
Patiriella exigua, Verrill, Amer. J. Sci. XXXV, 1913, p. 484.
Asterina exigua, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol Carn. Instn. X, 1921, p. 97, pl. vii, figs. 6, 7 (and synonymy).
Patiriella exigua, H. L. Clark, Rec. S. Aust. Mus. III, 1928, p. 392.

Locality.—Low Isles (10) (almost general in occurrence); Snapper Island, N. of Low Isles. Specimens were taken from under coral boulders and stones between tide-marks (10). Gen. Survey, Inner Ramparts, 20.iii.1929; Tripneustes Spit, 21.iii.1929; Asterina Spit, 20.iii.1929; Region F.9, 4.iv.1929; Three Isles, 5.v.1929.

Distribution.—Madagascar, Cape of Good Hope, Mauritius, Andaman and Nicobar Islands, Java, Moluccas, Philippines, South, East and North Australia.

Clark (*loc. cit.*) has recorded that this sea-star is abundant at Erub, and it is also common at the above localities.

The largest specimen has a diameter of 29 mm., but in the majority this measurement is between 18 and 25 mm. Ten specimens were collected in each of the localities given above, and all are five-rayed, except one which possesses six rays.

Echinaster luzonicus (Gray).

Othilia luzonica, Gray, Ann. Mag. Nat. Hist. VI, 1840, p. 282.
Echinaster luzonicus, H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 98, pl. x, figs. 2–4 (and synonymy).

Localities.—Gen. Survey, 24.iv.1929 (4). Upper platform of Luana Reef. Taken also by members of the Australian Museum Staff in the vicinity of the Western and Middle Moats. Station XVII, 9.iii.1929, about quarter-mile N. of North Direction Island, 19 fathoms, sand and thick Halimeda (1); Station XIX, 10.iii.1929 about half-mile N. of Eagle Island, 10 fathoms, shell gravel, rich Halimeda (2).

Distribution.—New Ireland, Queensland, New Caledonia, Amboina, Admiralty Islands, Ceylon, Philippines, New Britain, Northwest Australia and Torres Strait.

Four specimens were collected from under dead coral boulders on the weedy sand flat at Low Isles and seven secured from deeper water. The diversity in the number of rays is clearly illustrated on the specimens before me; of the shore forms the largest has five rays, two have six, and one seven. All tolerably complete specimens have two madreporites each. In life, all were of a more or less dark or blackish hue, but when dried, after preservation in alcohol, the colour varied considerably, as is usual in the species. Two are of a rusty red hue, with darker irregular blotches, while another is an ashen colour with dark sepia patches. The fourth is dark greenish yellow on the abactinal surface, and noticeably paler on the actinal surface. The adambulacral plates bear a distinct subambulacral spinelet near the margin of the furrow.

Metrodira subulata, Gray.

(Plate VIII, figs. 1 and 4.)

Metrodira subulata, Gray, Ann. Mag. Nat. Hist. VI, 1840, p. 282; Fisher, Bull. U.S. Nat. Mus. 100, III, 1919, p. 406 (and synonymy); H. L. Clark, "Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 100.

Localities.—Station XII, 24.ii.1929. Penguin Channel, 10–15½ fathoms, rock and shell gravel, mud on edges of pit (1). Station XXII, 11.iii.1929. To E. of Snake Reef, 13½ fathoms, mud, forams, shells (1).

Distribution.—Macclesfield Bank; Philippine Islands, Torres Strait, Aru, Amboina, N.W. Australia; N.E. Australia; George Sound, New Zealand; Bay of Bengal; Ceylon (*fide* Fisher, *loc. cit.*). In regard to the New Zealand record of the species, on the authority of Sladen, followed by Fisher, Mortensen* states that it may be regarded as fairly certain that *M. subulata* does not occur in New Zealand waters, and that the record was evidently based upon "unreliable Museum labels."

Clark (*loc. cit.*) doubts the accuracy of Bell's "Alert" identification. The present record, however, proves that the species extends down the coast of Queensland *via* the Great Barrier Reef from Torres Strait.

Specimens Examined.—Two five-rayed examples, R. = 60 mm., r. = 7·5 mm.; R. = 35 mm., r. = 3·5 mm.

* Papers from "Dr. Mortensen's Pacific Expedition, 1914–16, XXIX, Ech. New Zeal. and the Auckland-Campbell Islands," Vidensk. Medd. naturh. Foren. Kjöb. Bd. LXXIX, 1925, p. 263.

Acanthaster planci (Linnaeus).

Asterias planci, Linnaeus, Syst. Nat. ed. X, 1758, p. 823.
Acanthaster planci, H. L. Clark, " Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 101.

Locality.—Low Isles, reef, 20.vii.1929 (1).

Distribution.—Zanzibar, Arabian Gulf and Red Sea across to Society and Hawaiian Islands, including Philippines and Riu-kiu Islands, Moluccas, Fiji, Samoan Islands, Mauritius, Torres Strait and Queensland.

A single specimen, measuring 202 mm. across, is referable to this species.

Retaster insignis, Sladen.

Retaster insignis, Sladen, J. Linn. Soc. Zool. XVI, 1882, p. 200; Sladen, " Challenger " Zool. XXX, 1889, p. 482, pl. lxxvi, figs. 3, 4; pl. lxxvii, figs. 11, 12; Fisher, Bull. U.S. Nat. Mus. 100, III, 1919, p. 460; H. L. Clark, " Echinod. Fauna Torres Strait," Pap. Dept. Mar. Biol. Carn. Instn. X, 1921, p. 103.

Localities.—Station XVII, 9.iii.1929. About $\frac{1}{4}$ mile N. of North Direction Island, 19 fathoms, sand, thick Halimeda weed (2). Station XVI, 9.iii.1929. About $\frac{1}{2}$ mile W. of North Direction Island, 20 fathoms, stony (1).

Distribution.—Philippines; Amboina; Banda Sea; Arafura Sea; Torres Strait and Thursday Island; Samoa; Port Molle, Queensland and probably Port Jackson, New South Wales.

Three specimens: R. = 46 mm.; R. = 23·5 mm.; R. = 15·5 mm. According to the label the largest animal was in life dark red on a grey background.

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DESCRIPTION OF PLATE I.

Fig. 1.—*Stellaster princeps*, Sladen. Specimen from Western Australia (Austr. Mus Coll.) (R. = 128 mm.). Abactinal view. (Slightly under half nat. size.)

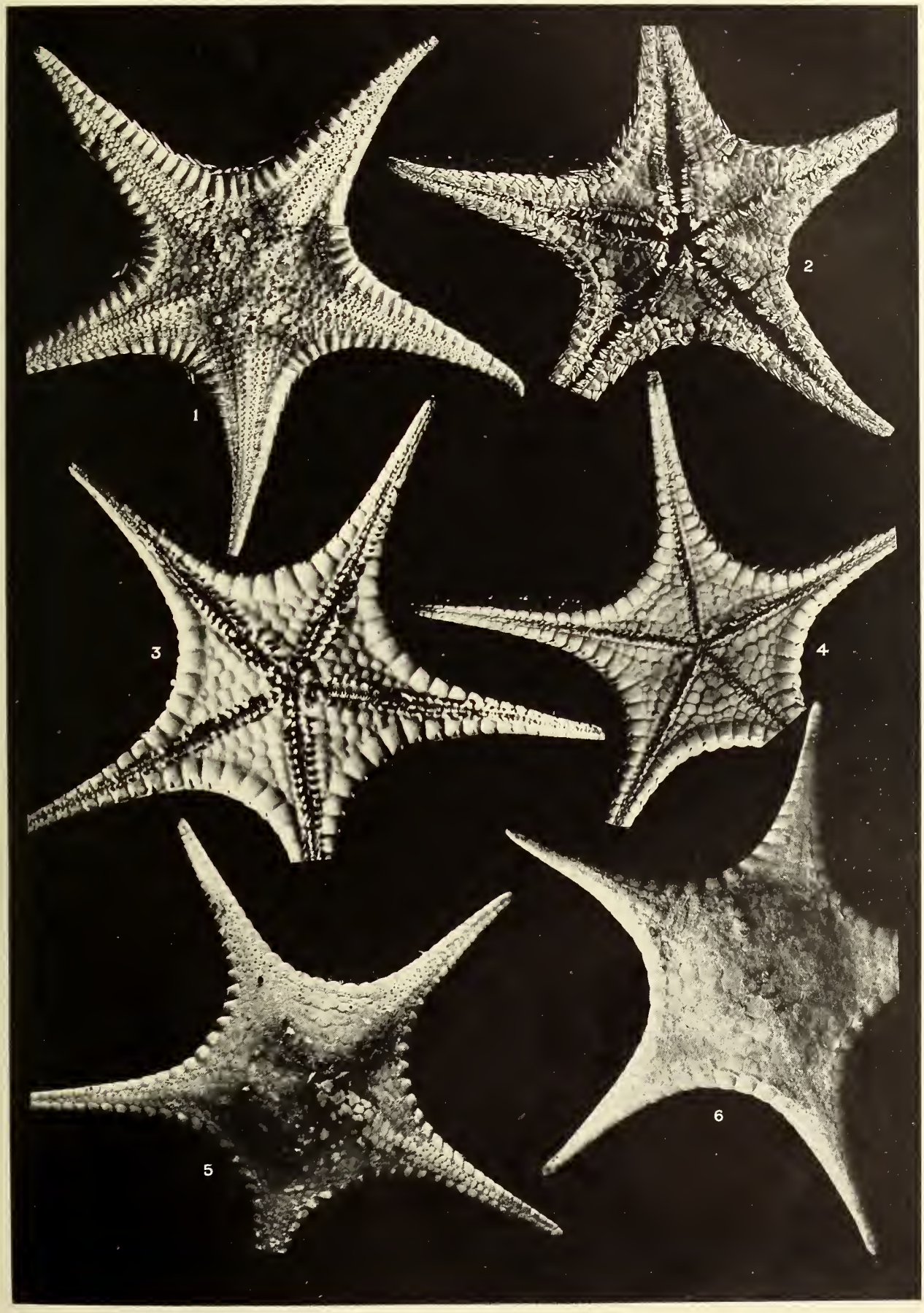
Fig. 2.—*Stellaster princeps*, Sladen. Actinal view of above specimen. (Slightly under half nat. size.)

Fig. 3.—*Stellaster equestris* (Retzius). Specimen from Nagasaki, Japan (Austr. Mus. Coll.) (R. = 58 mm.). Actinal view. (About nat. size.)

Fig. 4.—*Stellaster incei*, Gray. Specimen from Albany Passage, North Queensland (Austr. Mus. Coll.) (R. = 59 mm.). Actinal view. (Slightly under nat. size.)

Fig. 5.—*Stellaster incei*, Gray. Abactinal view of the above specimen (R. = 59 mm.). (Slightly under nat. size.)

Fig. 6.—*Stellaster equestris* (Retzius). Abactinal view of above specimen from Nagasaki, Japan (Austr. Mus. Coll.). (Slightly under nat. size.)



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DESCRIPTION OF PLATE II.

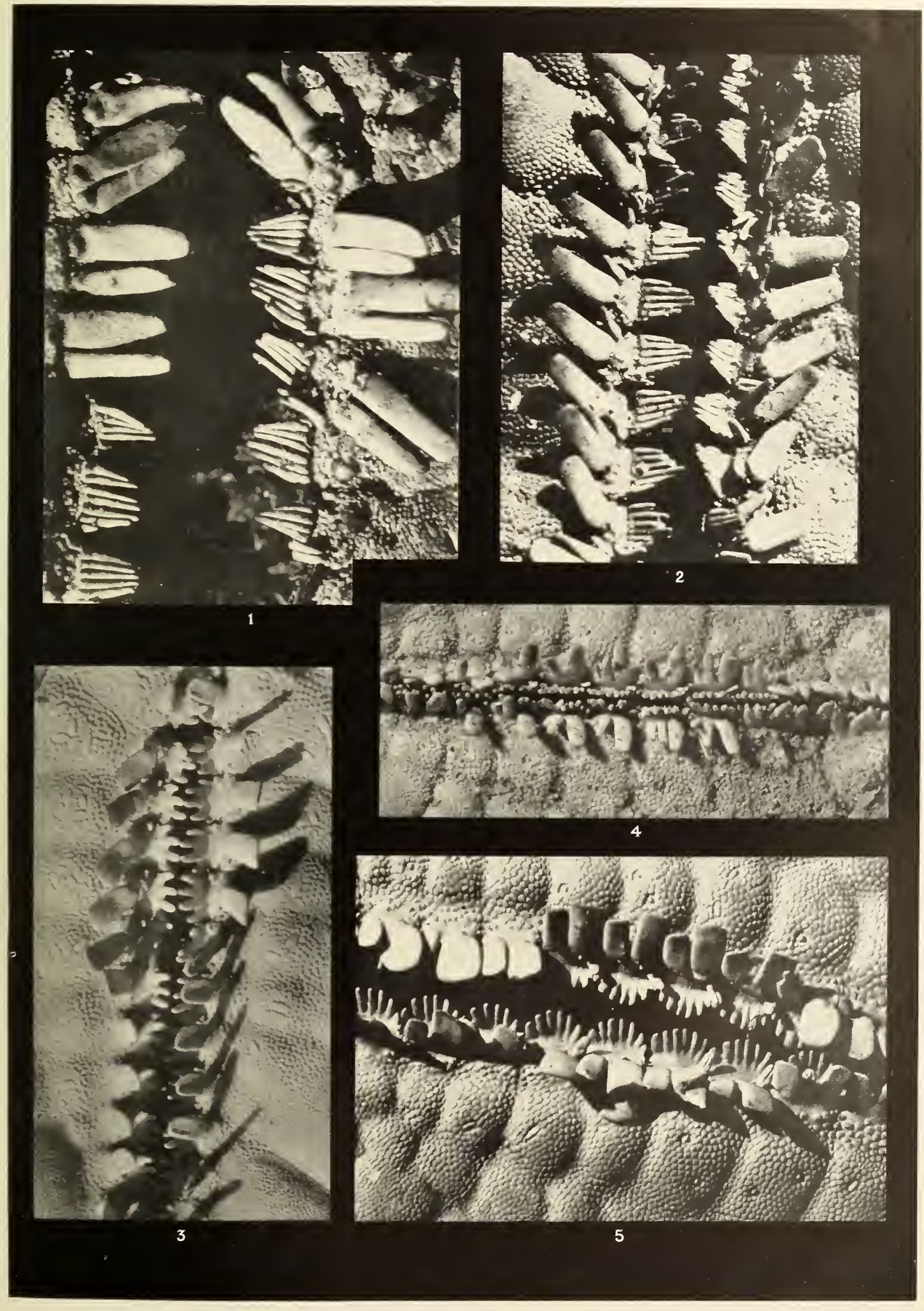
Fig. 1.—*Stellaster princeps*, Sladen. Specimen from Western Australia (R. = 128 mm.). Ambulacral furrow. (× 5.)

Fig. 2.—*Stellaster incei*, Gray. Specimen from Western Australia (R. = 69 mm.). Ambulacral furrow. (× 5.)

Fig. 3.—*Stellaster equestris* (Retzius). Specimen from Nagasaki, Japan (R. = 58 mm.). Ambulacral furrow. (× 5.)

Fig. 4.—*Stellaster incei*, Gray. Specimen from Albany Passage, North Queensland (R. = 59 mm.). Ambulacral furrow. (× 5.)

Fig. 5.—*Stellaster incei*, Gray. Specimen from Low Isles, North Queensland (R. = 82 mm.). Ambulacral furrow. (× 5.)



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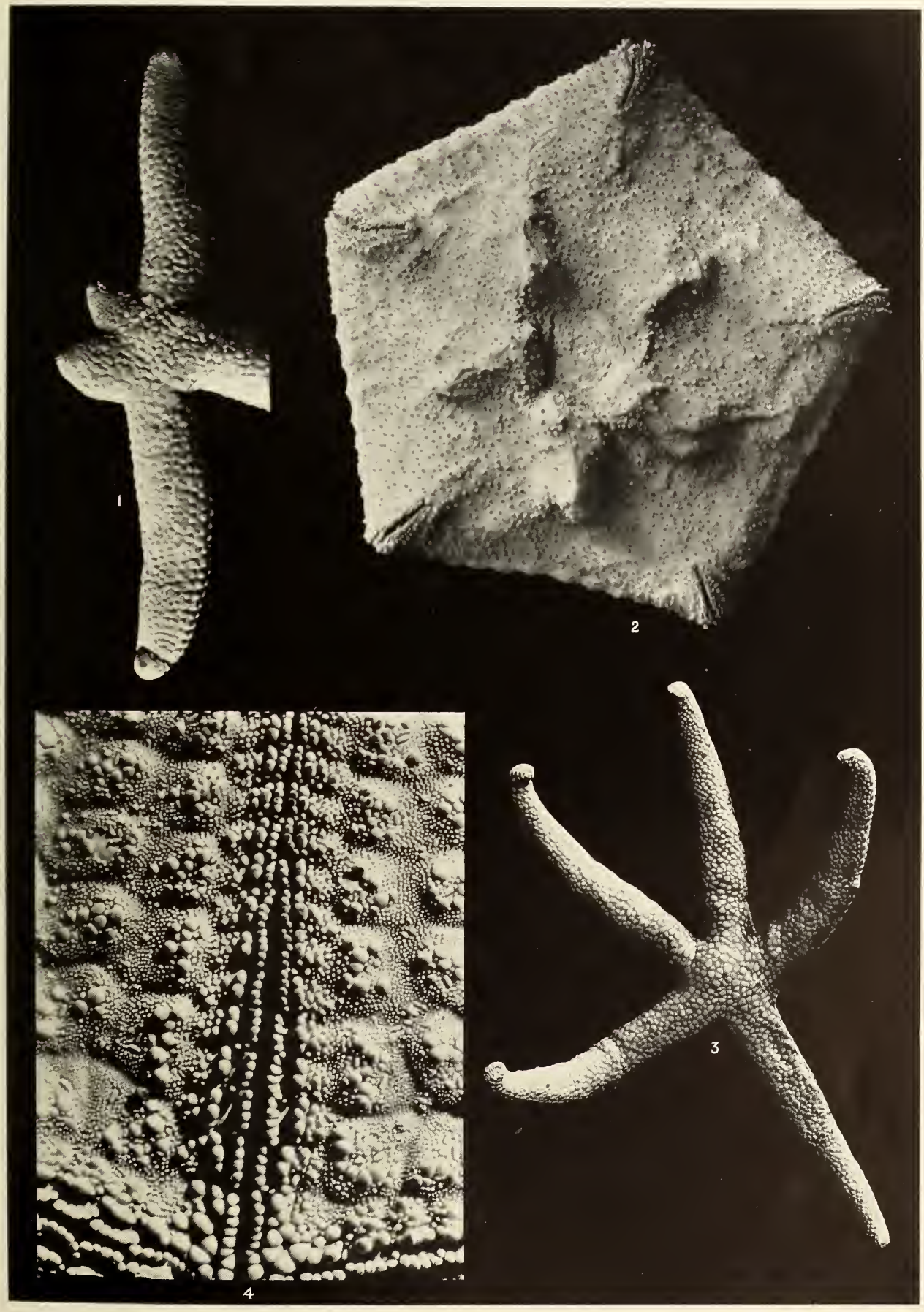
DESCRIPTION OF PLATE III.

Fig. 1.—*Linckia laevigata* (Linnaeus). Specimen from Low Isles. Abactinal view. (Slightly over nat. size.)

Fig. 2.—*Culcita novaeguineae* (M. and Tr.). Half-grown specimen from Low Isles, showing the five "humps" described in text. The continuous poriferous areas are more conspicuous near the margins. (About two-thirds nat. size.)

Fig. 3.—*Nardoa pauciforis* (v. Mart.). Specimen from Low Isles. Abactinal view. (Slightly over half nat. size.)

Fig. 4.—*Culcita novaeguineae* (M. and Tr.). Ambulacral furrow of juvenile specimen from Low Isles. (× 5.)



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DESCRIPTION OF PLATE IV.

FIG. 1.—*Nardoa novaecaledoniae* (Perrier). Specimen from Low Isles. Ambulacral furrow. (× 5.)

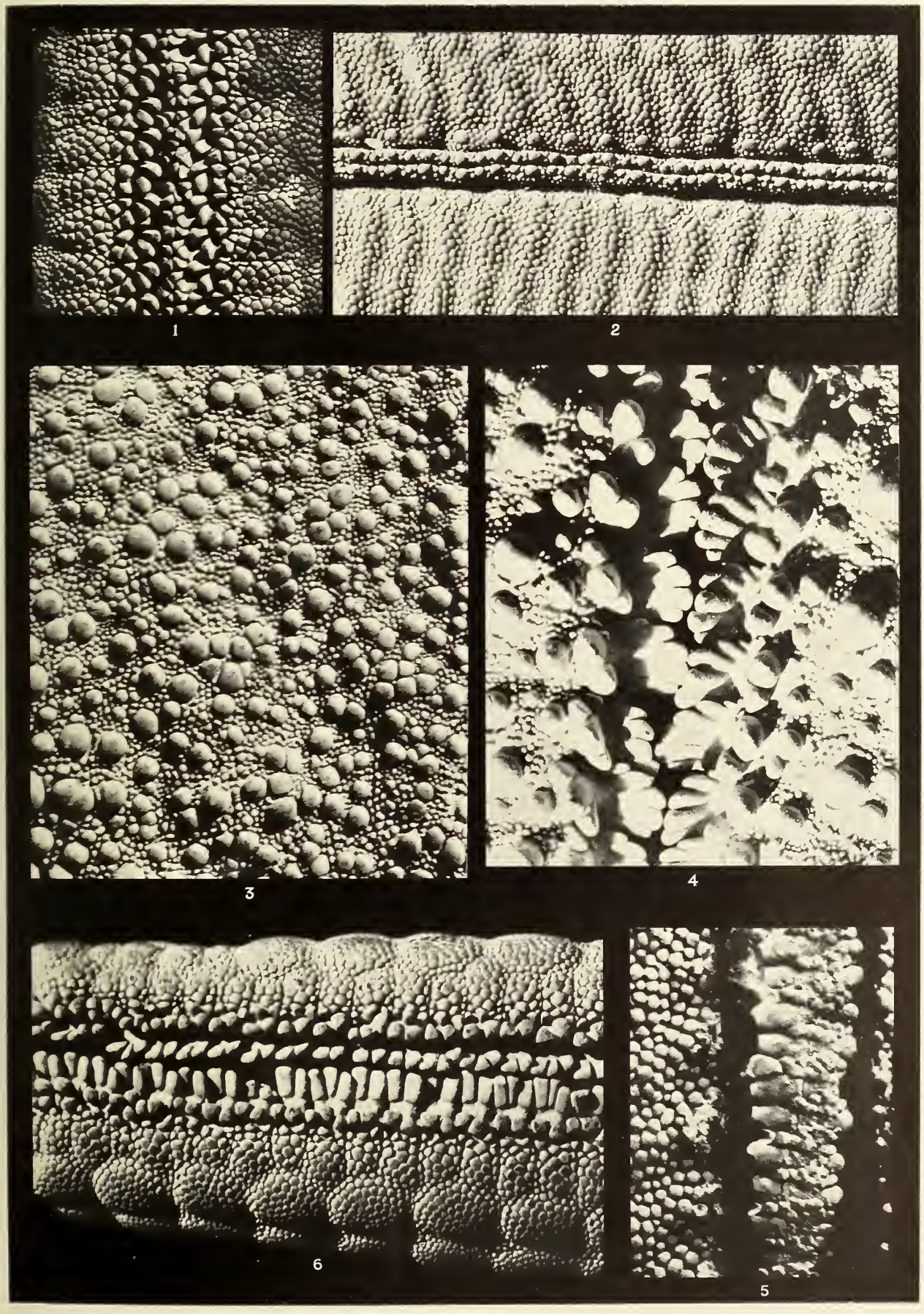
FIG. 2.—*Linckia laevigata* (Linnaeus). Specimen from Low Isles (R. = 157 mm.). Showing granules between the furrow spinelets. (× 5.)

FIG. 3.—*Culcita novaeguineae* (M. and Tr.). Portion of actinal surface of half-grown specimen from Low Isles. (× 5.)

FIG. 4.—*Culcita novaeguineae* (M. and Tr.). Same specimen as above showing ambulacral furrow. (× 5.)

FIG. 5.—*Linckia laevigata* (Linnaeus). Specimen from Low Isles (R. = 157 mm.). Dissection showing furrow spinelets separated by granules. (× 8.)

FIG. 6.—*Nardoa pauciforis* (v. Mart.). Specimen from Low Isles. Ambulacral furrow. (× 5.)



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DESCRIPTION OF PLATE V.

FIG. 1.—*Tosia queenslandensis*, sp. nov. Holotype (R. = 17 mm.). Abactinal view. (Slightly under × 2.)

FIG. 2.—*Tosia queenslandensis*, sp. nov. Actinal view of holotype. (Slightly under × 2.)

FIG. 3.—*Nardoa novaecaledoniae* (Perrier). Four-rayed example from Low Isles. (Slightly over half nat. size.)

FIG. 4.—*Anthenea tuberculosa*, Gray. R. = 22 mm. Actinal view. (About 1½ times nat. size.)

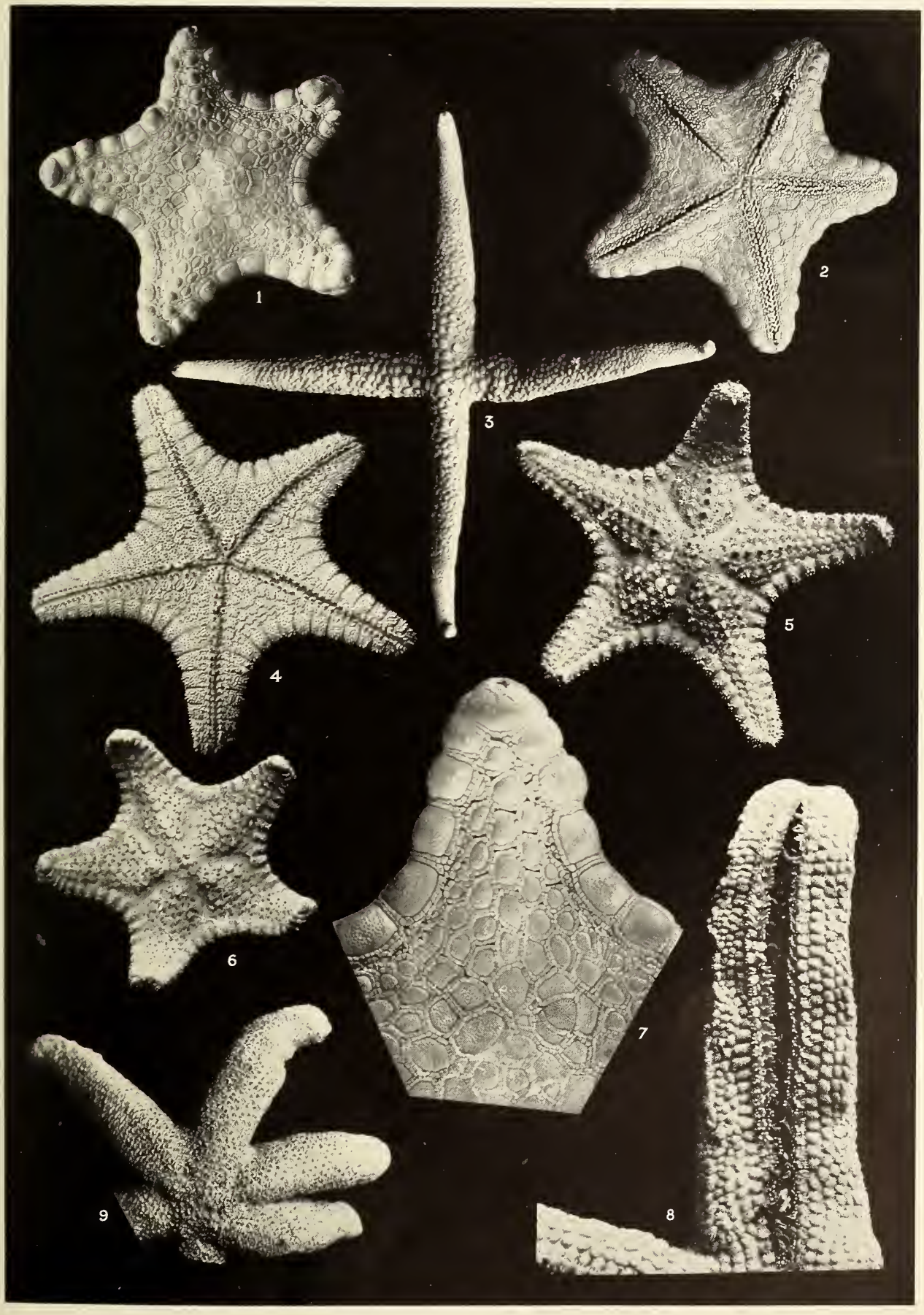
FIG. 5.—*Anthenea tuberculosa*, Gray. Abactinal view of same specimen. (About 1½ times nat. size.)

FIG. 6.—*Anthenea tuberculosa*, Gray. R. = 16 mm. Abactinal view. (Slightly over 1½ times nat. size.)

FIG. 7.—*Tosia queenslandensis*, sp. nov. Portion of abactinal surface of holotype. (Slightly over × 4.)

FIG. 8.—*Nepanthia* (? *brevis*, Perrier). R. = 34 mm. Ambulacral furrow. (Slightly over × 3.)

FIG. 9.—*Nepanthia* (? *brevis*, Perrier). Abactinal view of above specimen. (Slightly over nat. size.)



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DESCRIPTION OF PLATE VI.

Fig. 1.—*Oreaster australis*, Lütken. Actinal view of smallest juvenile specimen (R. = 20 mm.). (Nearly × 2.)

Fig. 2.—*Oreaster australis*, Lütken. Actinal view of smallest adult specimen (R. = 78 mm.). (Slightly under nat. size.)

Fig. 3.—*Oreaster alveolatus* (Perrier). Abactinal view of one of three specimens in the collections of the Australian Museum from New Caledonia (R. = 90 mm.). (About two-thirds nat. size.)

Fig. 4.—*Oreaster australis*, Lütken. Abactinal view of largest young adult (R. = 91 mm.). (Slightly over two-thirds nat. size.)

Fig. 5.—*Oreaster alveolatus* (Perrier). Actinal view of above specimen (fig. 3) (R. = 90 mm.). (Slightly over two-thirds nat. size.)

Fig. 6.—*Oreaster australis*, Lütken. Abactinal view of smallest juvenile specimen. Same specimen as fig. 1. (Nearly twice nat. size.)

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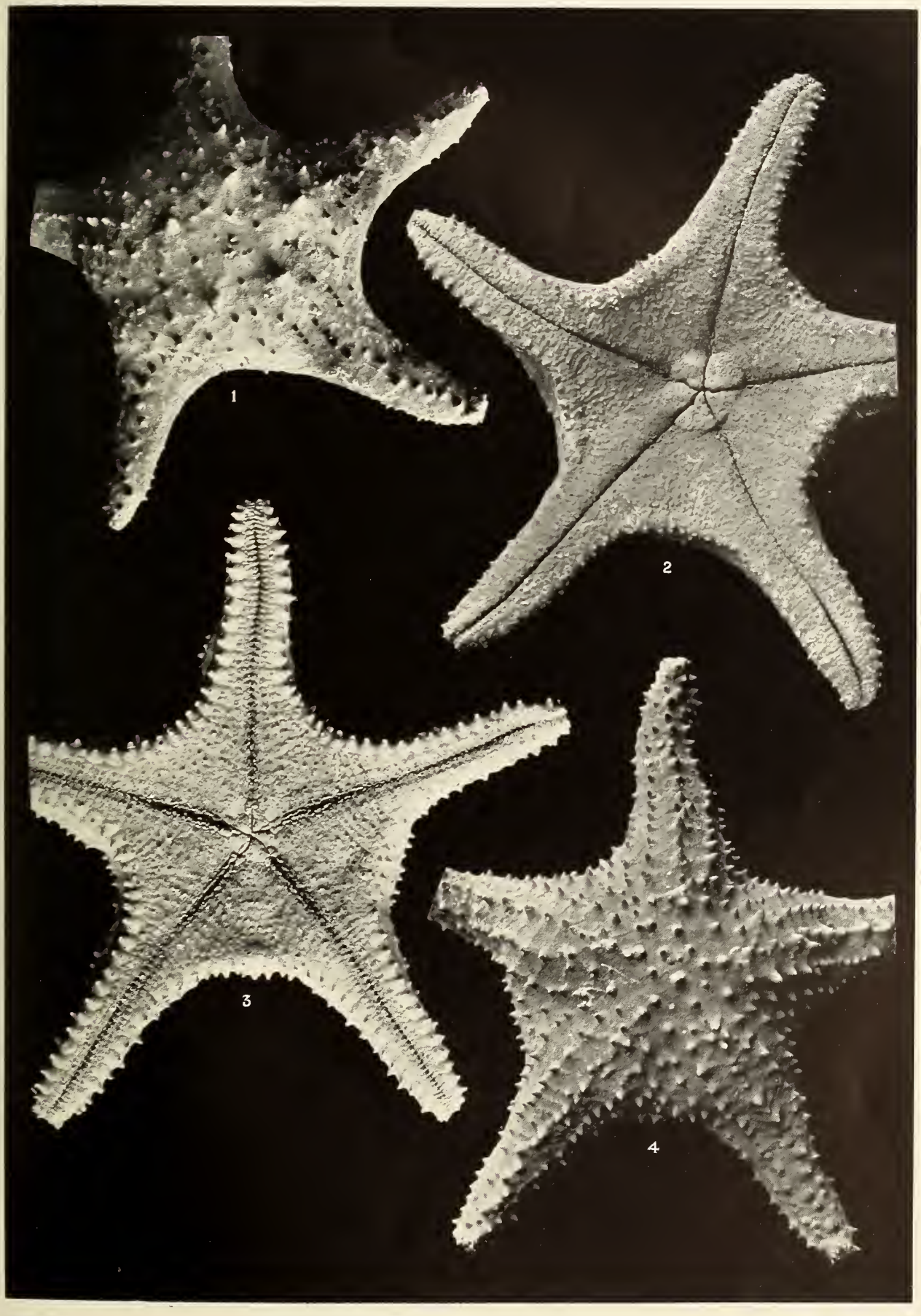
DESCRIPTION OF PLATE VII.

Fig. 1.—*Oreaster australis*, Lütken. Abactinal view of specimen from 18 miles S.W. by S. of Lady Elliot Island, Queensland. Collected by F.I.S. "Endeavour" and identified by Dr. H. L. Clark (Austr. Mus. Coll.) (R. = 120 mm.). (× 2.)

Fig. 2.—*Oreaster australis*, Lütken. Actinal view of above specimen (R. = 120 mm.). (× 2.)

Fig. 3.—*Oreaster australis*, Lütken. Actinal view of another specimen collected by the "Endeavour" in the same locality as the above specimen and identified by Dr. H. L. Clark (Austr. Mus. Coll.) (R. = 125 mm.). (× 2.)

Fig. 4.—*Oreaster australis*, Lütken. Abactinal view of above specimen (R. = 125 mm.). (× 2.)



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DESCRIPTION OF PLATE VIII.

Fig. 1.—*Metrodira subulata*, Gray. R. = 35 mm. Actinal view. (× 4.)

Fig. 2.—*Astropecten granulatus*, M. and Tr. R. = 38 mm. Abactinal view. (Slightly over half nat. size.)

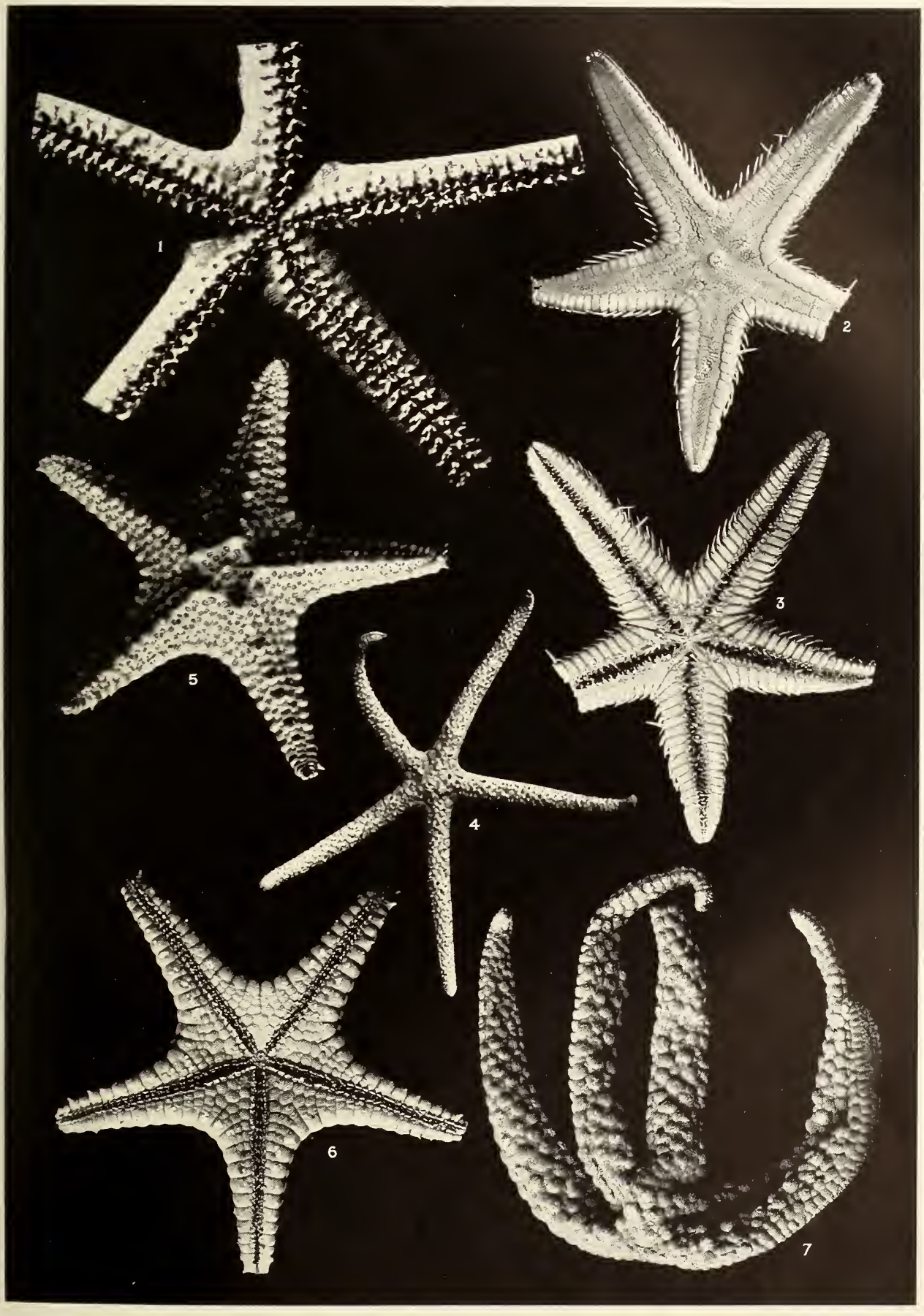
Fig. 3.—*Astropecten granulatus*, M. and Tr. Actinal view of above specimen. (Slightly over half nat. size.)

Fig. 4.—*Metrodira subulata*, Gray. Abactinal view (R. = 35 mm.). (Slightly over nat. size.)

Fig. 5.—*Oreaster australis*, Lütken. Abactinal view of largest juvenile specimen (R. = 33·5 mm.). (Slightly over nat. size.)

Fig. 6.—*Oreaster australis*, Lütken. Actinal view of above specimen (R. = 33·5 mm.). (Slightly over nat. size.)

Fig. 7.—*Nardoa rosea*, H. L. Clark. Abactinal view. Alternating large and small superomarginals seen best on second ray from left (R. = 72 mm.). (About nat. size.)



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DESCRIPTION OF PLATE IX.

FIG. 1.—*Tamaria megaloplax* (Bell). Portion of abactinal surface of ray of Bell's Albany Island specimen collected by the "Alert." Specimen now regarded as holotype (Brit. Mus. Coll.). (× 4.)

FIG. 2.—*Tamaria megaloplax* (Bell). Portion of actinal surface of ray of holotype. (× 4.)

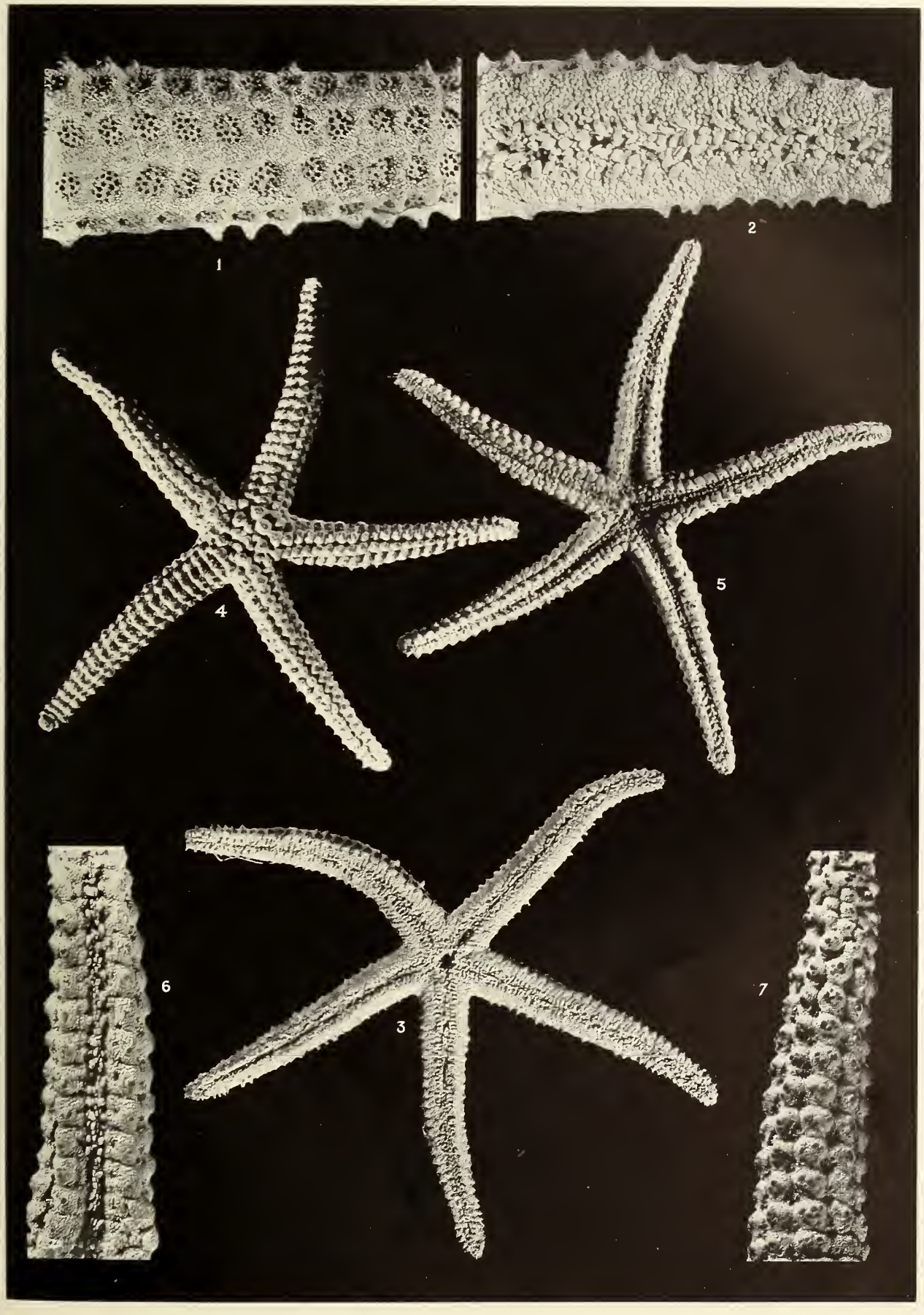
FIG. 3.—*Tamaria megaloplax* (Bell). Actinal view of Bell's Albany Island specimen, the holotype. (Nat. size.)

FIG. 4.—*Tamaria fusca*, Gray. Abactinal view of Gray's holotype (Brit. Mus. Coll.). (× 1½.)

FIG. 5.—*Tamaria fusca*, Gray. Actinal view of Gray's holotype. (× 1½.)

FIG. 6.—*Tamaria fusca*, Gray. Portion of actinal surface of ray of Gray's holotype. (× 4.)

FIG. 7.—*Tamaria fusca*, Gray. Portion of abactinal surface of ray of Gray's holotype. (× 4.)



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DESCRIPTION OF PLATE X.

Fig. 1.—*Oreaster australis*, Lütken. Abactinal view of old adult specimen (R. = 111 mm.). (Slightly over half nat. size.)

Fig. 2.—*Oreaster australis*, Lütken. Abactinal view of smallest young adult specimen (R. = 78 mm.). (Slightly under nat. size.)

Fig. 3.—*Oreaster australis*, Lütken. Actinal view of old adult specimen (R. = 111 mm.). (Slightly over half nat. size.)

Fig. 4.—*Oreaster australis*, Lütken. Largest young adult specimen (R. = 91 mm.). (About two-thirds nat. size.)

Fig. 5.—*Tamaria hirsuta* (Koehler). Abactinal view of one of Studer's " Gazelle " specimens from north-west Australia which he identified as *O. fuscus*, Gray. It was also referred to by H. L. Clark under the name of *Tamaria fusca*, Gray (R. = about 21 mm.) (Mus. Comp. Zool. Coll.). (About × $1\frac{1}{2}$.)

Fig. 6.—*Tamaria hirsuta* (Koehler). Abactinal view of an Australian Museum specimen from Western Australia which is identical with the " Gazelle " series (R. = 26 mm.). (Slightly over nat. size.)

Fig. 7.—*Tamaria hirsuta* (Koehler). Actinal view of same specimen (R. = 26 mm.). (Slightly over nat. size.)

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DESCRIPTION OF PLATE XI.

Fig. 1.—*Tamaria fusca*, Gray. Actinal view of juvenile specimen from Station XIV (R. = 7 mm.). (About × 4.)

Fig. 2.—*Tamaria fusca*, Gray. Abactinal view of same specimen. (About × 4.)

Fig. 3.—*Tamaria fusca*, Gray. Abactinal view of specimen from Station XVI showing the developing characters of the adult (R. = 15·5 mm.). (Slightly over × 2.)

Fig. 4.—*Tamaria fusca*, Gray. Actinal view of same specimen. (Slightly over × 2.)

Fig. 5.—*Tamaria*, sp. ?. Actinal view of specimen from Port Curtis, Queensland (Austr. Mus. Coll.) (R. = 103·5 mm.). (About two-thirds nat. size.)

Fig. 6.—*Tamaria*, sp. ?. Abactinal view of same specimen. (About two-thirds nat. size.)

Fig. 7.—*Tamaria*, sp. ?. (? *Linckia marmorata*, Simpson and Rudmose-Brown [*non* Mich.] [in part]). Actinal view of a specimen from Zanzibar in the British Museum (Natural History), and labelled by Bell "*Ophidiaster fuscus*." (Nat. size.)

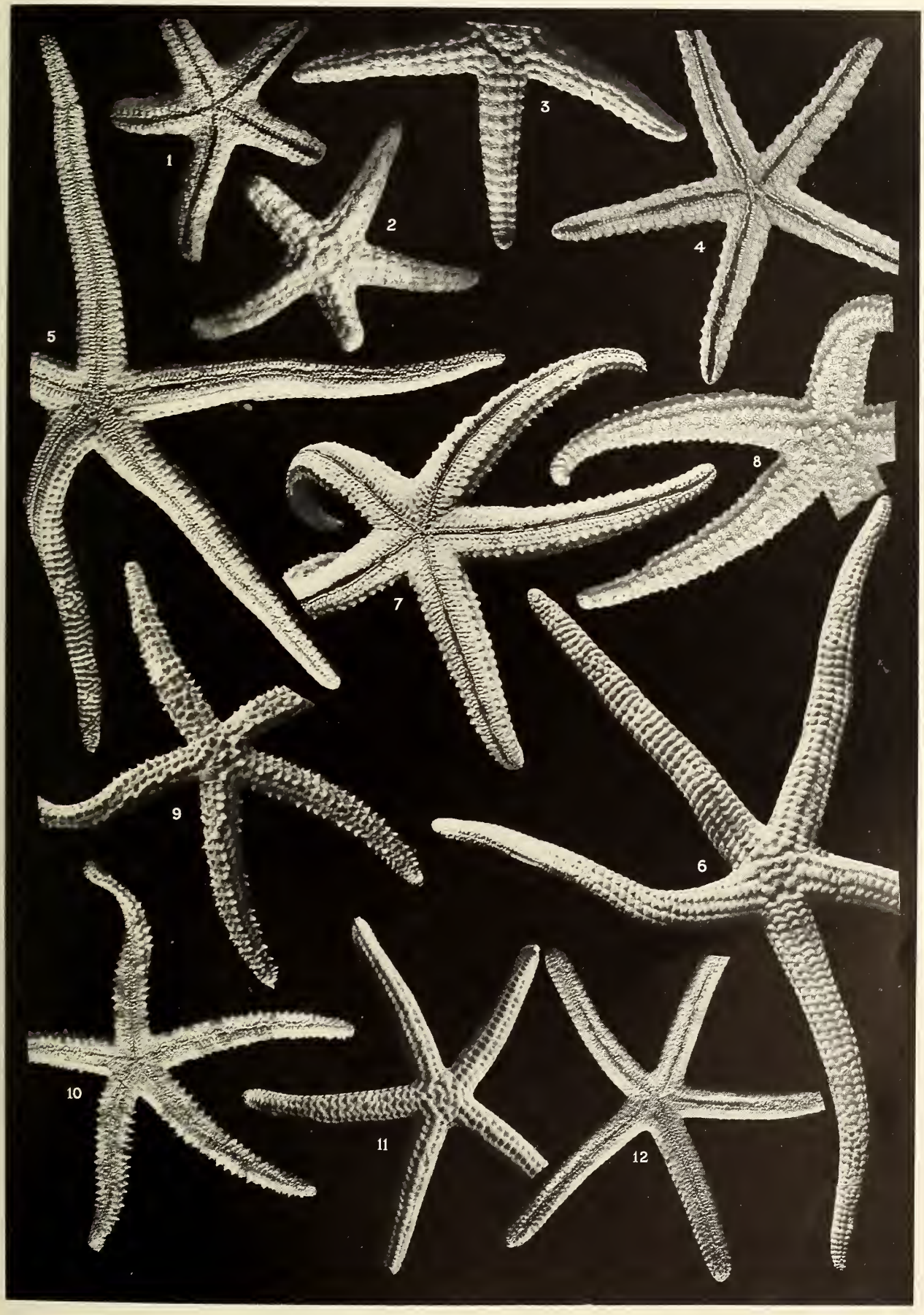
Fig. 8.—*Tamaria*, sp. ?. Abactinal view of same specimen. (Nat. size.)

Fig. 9.—*Tamaria hirsuta* (Koehler). Abactinal view of specimen from Holothuria Bank (Mus. Comp. Zool. Coll.), labelled by Bell as "*Linckia megaloplax*," and referred to by H. L. Clark under *Tamaria fusca*, Gray (R. = 44 mm.). (Slightly under nat. size.)

Fig. 10.—*Tamaria hirsuta* (Koehler). Actinal view of same specimen. (Slightly under nat. size.)

Fig. 11.—*Tamaria*, sp. ?. Abactinal view of specimen from Port Curtis, Queensland (Austr. Mus. Coll.) (R. = 34 mm.). (About nat. size.)

Fig. 12.—*Tamaria*, sp. ?. Actinal view of same specimen. (About nat. size.)



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DESCRIPTION OF PLATE XII.

Fig. 1.—*Tamaria fusca*, Gray. Abactinal view of portion of ray. Specimen from Station XIV (R. = 7 mm.). (× 15.)

Fig. 2.—*Tamaria ornata* (Koehler). Abactinal view of portion of ray. Specimen was labelled by Bell as *megaloplax*, and reduced to the synonymy of *fusca* by H. L. Clark (1921). Specimen from Holothuria Bank (R. = 22 mm.) (Mus. Comp. Zool. Coll.). (× 7.)

Fig. 3.—*Tamaria*, sp. ?. Portion of abactinal surface of ray of specimen from Port Curtis, Queensland (R. = 34 mm.). (× 10.)

Fig. 4.—*Tamaria*, sp. ? (? *Linckia marmorata*, Simpson and Rudmose-Brown [*non* Mich.] [in part]). Portion of actinal surface of ray of specimen from Zanzibar in the British Museum (Nat. Hist.), and labelled by Bell as "*Ophidiaster fuscus*." (× 4.)

Fig. 5.—*Ophidiaster propinquus*, sp. nov. Actinal view of holotype (R. = 26·5 mm.). (× 1½.)

Fig. 6.—*Tamaria*, sp. ?. Same specimen as fig. 4. Portion of abactinal surface. (× 4.)

Fig. 7.—*Tamaria fusca*, Gray. Actinal view of specimen from Port Denison, Queensland (R. = 30·5 mm.). (Austr. Mus. Coll.). (Slightly over nat. size.)

Fig. 8.—*Tamaria megaloplax* (Bell). Abactinal view of Bell's "Alert" Albany Island specimen. Specimen regarded as holotype. (Brit. Mus. Coll.). (Nat. size.)

Fig. 9.—*Tamaria*, sp. ?. Abactinal view of specimen from Fitzroy Island, Queensland, 12 fathoms (Austr. Mus. Coll.) (R. = 29 mm.). (Slightly over nat. size.)

Fig. 10.—*Tamaria fusca*, Gray. Portion of abactinal surface of disc and ray of specimen from Station XVI (R. = 15·5 mm.). (× 6.)

Fig. 11.—*Ophidiaster propinquus*, sp. nov. Abactinal view of holotype (R. = 26·5 mm.). (× 1½.)

Fig. 12.—*Tamaria megaloplax* (Bell). Abactinal view of specimen from Station XXII (R. = 31·5 mm.). (Slightly under × 1½.)

Fig. 13.—*Tamaria*, sp. ?. Same specimen as fig. 9. Actinal view. (Slightly over nat. size.)

Fig. 14.—*Tamaria megaloplax* (Bell). Same specimen as fig. 12. Actinal view. (Slightly under × 1½.)

Fig. 15.—*Tamaria fusca*, Gray. Same specimen as fig. 7. Abactinal view. (Slightly over nat. size.)

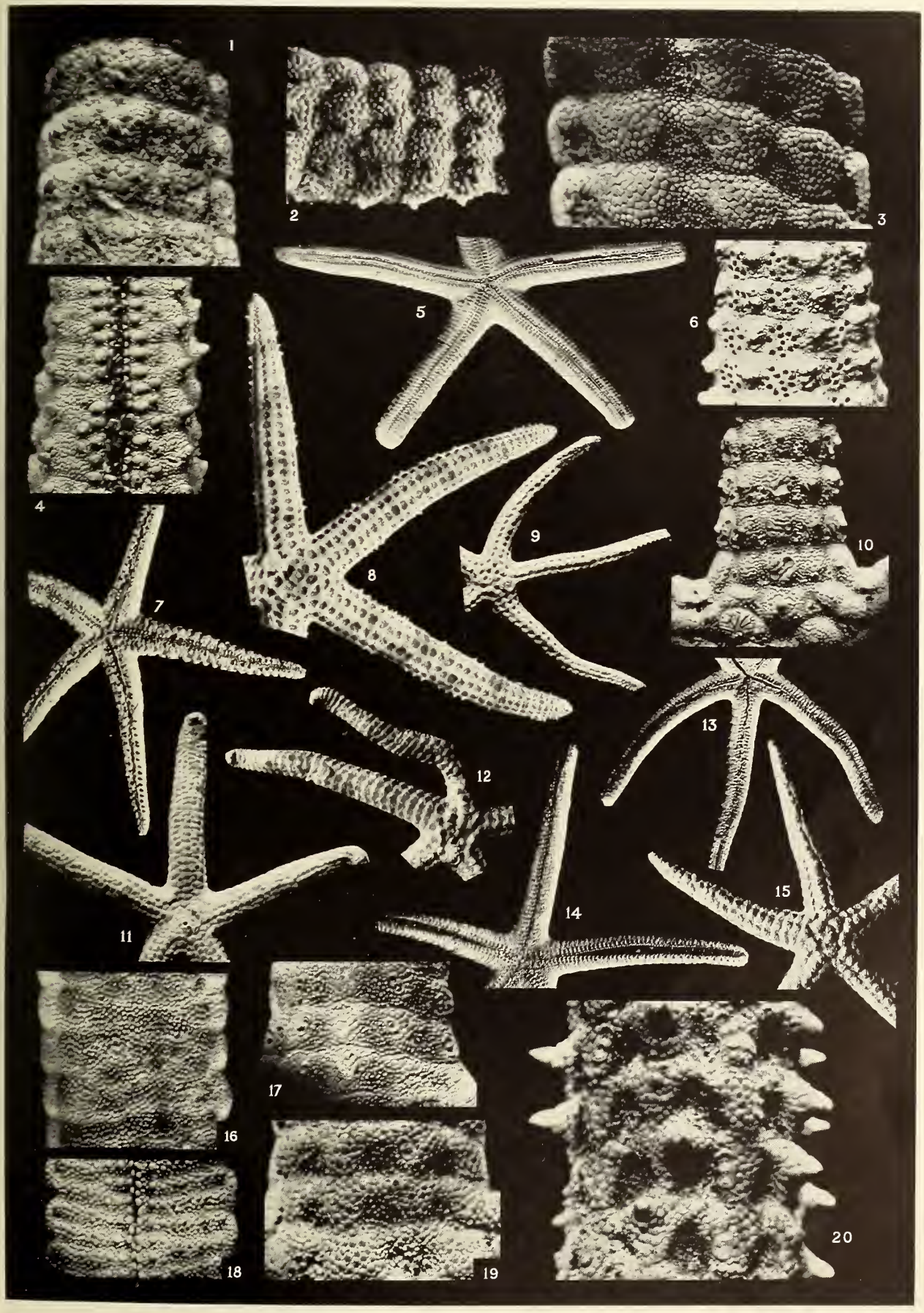
Fig. 16.—*Ophidiaster propinquus*, sp. nov. Granulation of abactinal surface of ray of holotype (R. = 26·5 mm.). (× 7.)

Fig. 17.—*Tamaria fusca*, Gray. Granulation of abactinal surface of ray. Same specimen as figs. 7 and 15. (About × 6.)

Fig. 18.—*Ophidiaster propinquus*, sp. nov. Granulation of actinal surface of ray of holotype. (About × 7.)

Fig. 19.—*Tamaria fusca*, Gray. Portion of abactinal surface of ray and disc. Same specimen as figs. 7 and 15. (About × 6.)

Fig. 20.—*Tamaria hirsuta* (Koehler). Portion of abactinal surface of ray of Holothuria Bank specimen labelled by Bell as "*Linckia megaloplax*" and referred to by H. L. Clark (1921) under *T. fusca* (Mus. Comp. Zool. Coll.) (R. = 44 mm.). (× 7.)



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